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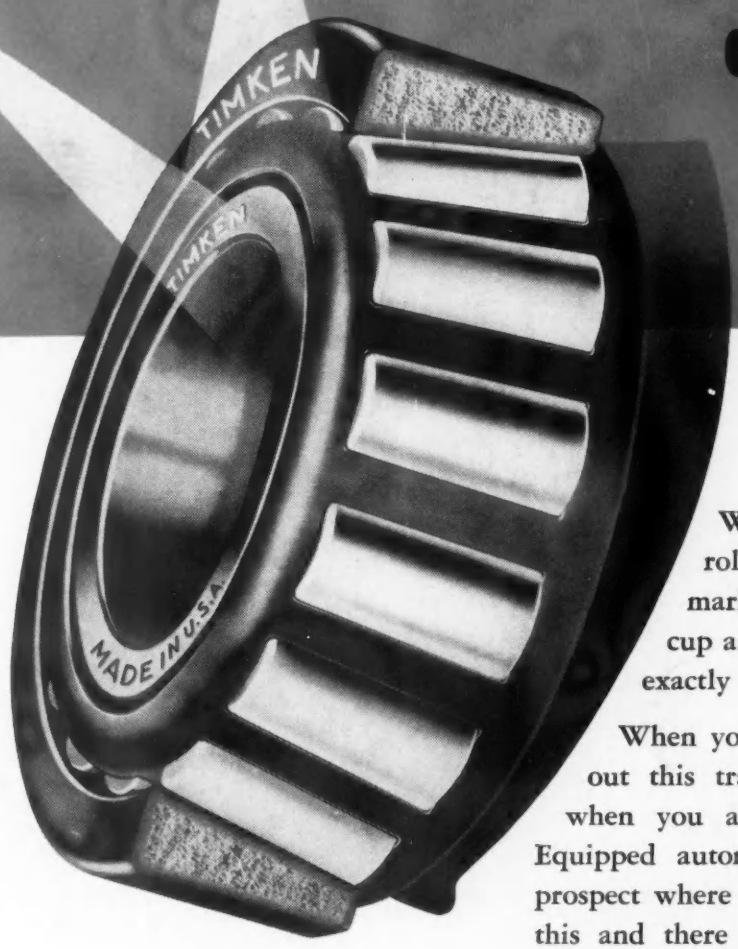
AUTOMOTIVE and Aviation INDUSTRIES

FEBRUARY 15, 1944

THE LIBRARY OF CONGRESS SERIAL RECORD
FEB 23 1944

ONE LOOK . . and no questions asked!



When you're buying a tapered roller bearing look for the trade-mark "TIMKEN" stamped on *both* cup and cone. If you see it you know exactly what you're getting.

When you sell a Timken Bearing point out this trade-mark to your buyer. And when you are selling a Timken Bearing Equipped automobile, truck or bus tell the prospect where Timken Bearings are used. Do this and there are no questions asked about bearings. No questions asked such as: "Who made them?" "Are they made of good steel?" "Are they precision made?" "Who uses them?" "Is the design correct?"

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

FEB 21 1944

Precision in Wartime — Finishing diesel engine pistons for battleships

In 1944

LET'S WORK FOR VICTORY

Only reconversion planning NOW can avert the widespread unemployment otherwise inevitable in the period between cessation of war production and resumption of peacetime production. Not that we have won the war, we haven't, and a long, desperate battle lies ahead. Even so, every bit of postwar planning done now will help in far greater ratio, when V-Day comes, to provide for the stricken people of a ravaged world, in putting our demobilized soldiers and war workers back to work on useful jobs.

If your postwar plans include precision finishing, HEALD ENGINEERING is available, now. Long and varied experience in solving countless problems in precision boring and grinding in consumer and heavy industries, plus our undiminished present efforts in war production, can be immensely helpful. We'll be glad to work with you.

But Plan For Peace

THE HEALD MACHINE CO., Worcester, Mass.

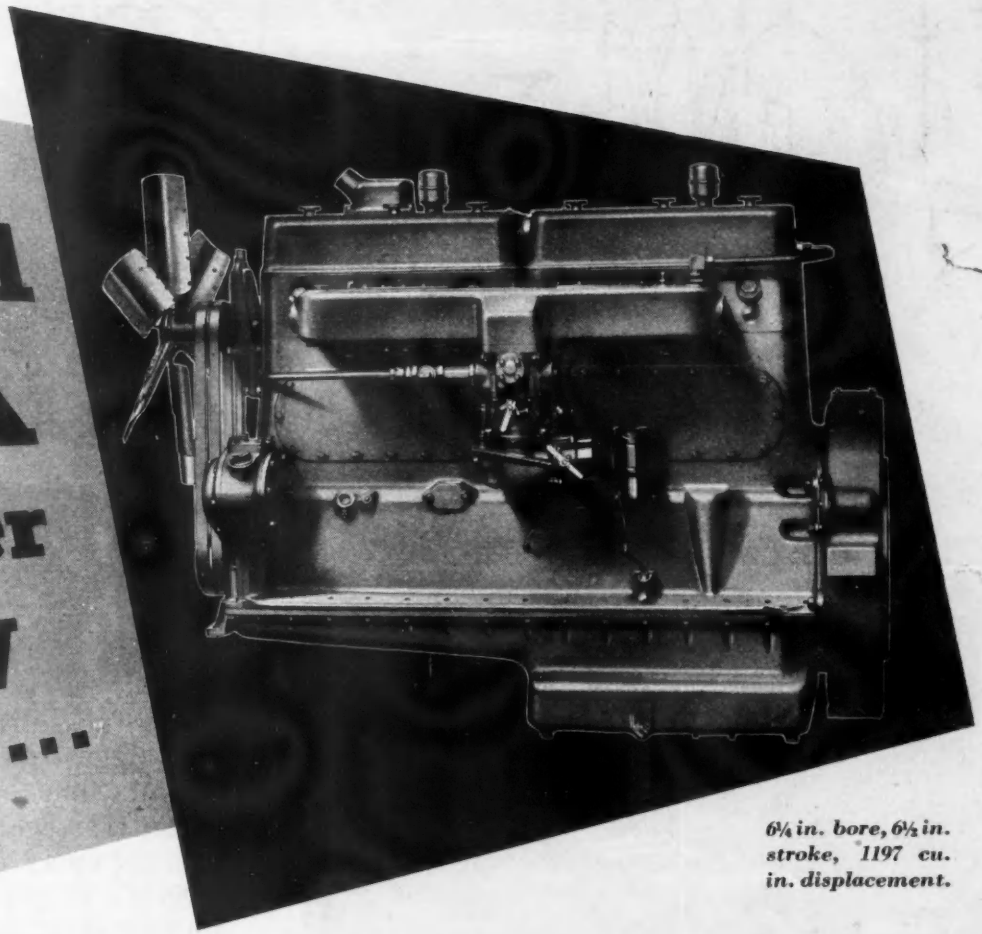
Postwar precision operations will include Heald Bore-Matics like this for facing automotive flywheels.

In 194V the most tremendous shortage of goods this world has ever known must be satisfied — by you and your competitors. Planning now for postwar production will eliminate many bottlenecks later — and if problems involve precision Heald will gladly cooperate in their solution. Although our staff of 250 engineers are engaged on war problems, their experience in finishing peacetime products from automobiles to sewing machines is also available to help in your postwar planning.

In 1944

for More Precision Faster, bring your problem to Heald

Model WAK Super Duty Six...



6¼ in. bore, 6½ in. stroke, 1197 cu. in. displacement.

WAUKESHA ENGINES

deliver maximum power... burn gasoline or butane

●This is *the* engine for the super trucks and busses of tomorrow—oil field service—and for pumps, generators and other mobile industrial equipment. With every modern feature of design and construction—it delivers more than 225 hp. at 1600 r.p.m.—burns gasoline or butane—and maintenance is easy and economical.

The Super Duty Six lives up to its name. Built to take it... and take it... and still be able to dish it out. Rugged... to the last fine detail... from oil pan to head.

Crankcase and cylinder frame are cast as one unit... so braced as to give the entire structure *remarkable rigidity*. Riding in its seven hefty, husky, four-inch bearings, the heat-treated steel crankshaft is positively aligned... stays that way.

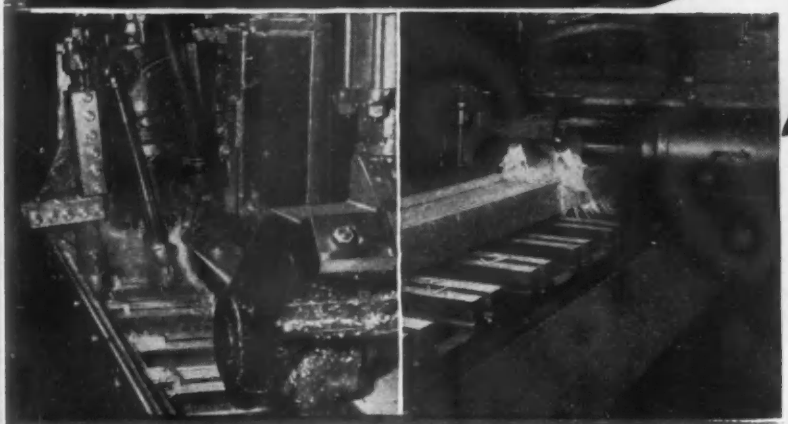
When servicing a Super Duty Six, you do it the easy way—that's another Waukesha construction advantage. Valve grinding is simplified. Since it's an overhead valve engine, you remove the heads and do it where it's most convenient. Each cylinder is a wet type sleeve. Press it from the main case and replace it—it's that easy.

Include this Waukesha Engine in making your post-war plans. Write for Bulletin 1138.

MORE POWER FOR VICTORY

WAUKESHA MOTOR COMPANY, WAUKESHA, WIS. • NEW YORK • TULSA • LOS ANGELES

Sixty Feet of High Speed Millin



Automatic Horizontal...Vertical and Variable Angle Twist Milling

Contour milling cuts are taken in both horizontal and vertical planes. Illustrated is one of the vertical cutter head assemblies. Under template control, this head tilts off-vertical to any required angle up to 15°, toward either the front or back of the machine. Thus the twist or varying bevel cuts needed on most aircraft spar beams are quickly and accurately milled.

Eight Cutter Heads for 360 HP Total!

The two carriages house eight cutter motor assemblies . . . four 3,600 RPM, 30 HP horizontal type, and four 10,800 RPM, 15 HP vertical type. All heads may be used simultaneously. Due to a special water cooling system, motors are capable of a 100% overload when work requires, developing a total of 360 HP. Lineal velocities of cutters in operation range up to 9,000 feet per minute.

The biggest Automatic Contour Milling Machine ever built, for milling faster than ever before, the huge wing channel spars for America's fighting aircraft. With two carriages under automatic G. E. Thymotrol feed control and eight cutter motor assemblies under automatic template control, the production capacity of this newest Onsrud A80-A is something you almost have to see to believe. Designed for milling aircraft aluminum alloy extrusions or forged billets, this A80-A incorporates all the features of standard Onsrud automatic contour milling machines. Information on request.

ONSRUD MACHINE WORKS, INC.
3925 Palmer Street, Chicago 47, Illinois
Sales Offices in all Principal Cities

Onsrud

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This kind of thinking is as intensely interesting as it is thoroughly practical. Ahlberg's experience and facilities are available to you—a letter makes the contact. Ahlberg Engineering Counsel is available at 24 factory branches.

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CJB BALL BEARINGS

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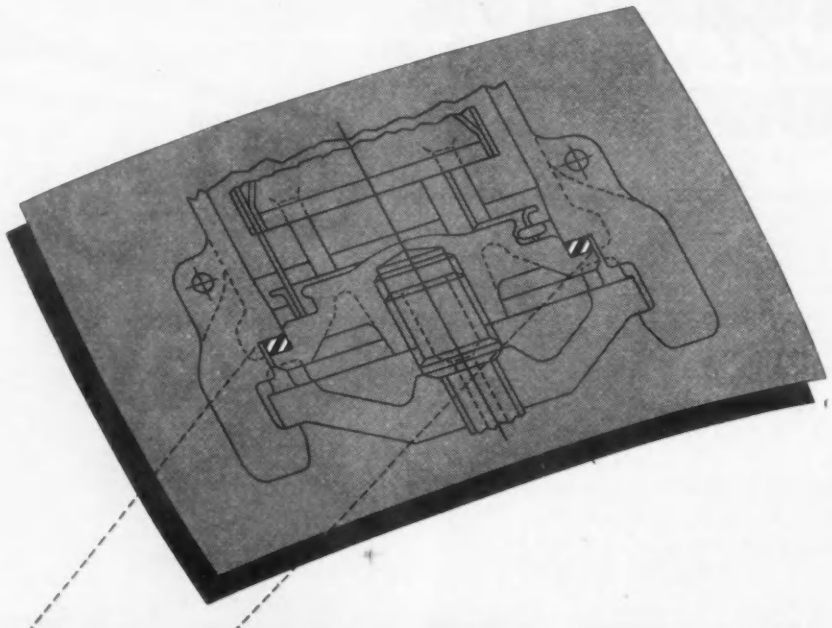


THIS GASKET DEFIES THE ATTACK OF AROMATIC FUEL

HERE'S a gasket that does not deteriorate nor swell appreciably nor become sticky when exposed to aromatic blend gasoline! It was die-cut from an Armstrong's Cork-and-Synthetic-Rubber Composition—one of ten sealing materials developed by Armstrong for use with aromatic fuel.

This Armstrong's Gasket is permanently resilient . . . assuring a tight seal. It does not stick to metal; thus it facilitates removal of parts. **It stays fit for re-assembly.** This advantage makes it especially desirable for use where periodical cleaning is necessary, as in the case of the fuel strainer shown in the drawing above.

In addition to cork-and-synthetic-rubber compositions, Armstrong manufactures a wide variety of other sealing materials for use in the automotive and aviation industries. These include cork compositions, cork-and-rubber compositions, synthetic rubber compositions, fiber sheet packings, rag felt papers, and natural cork products. Many of these materials are available not only in gasket form, but also in sheet and roll goods, tapes, molded shapes, and extruded rings.

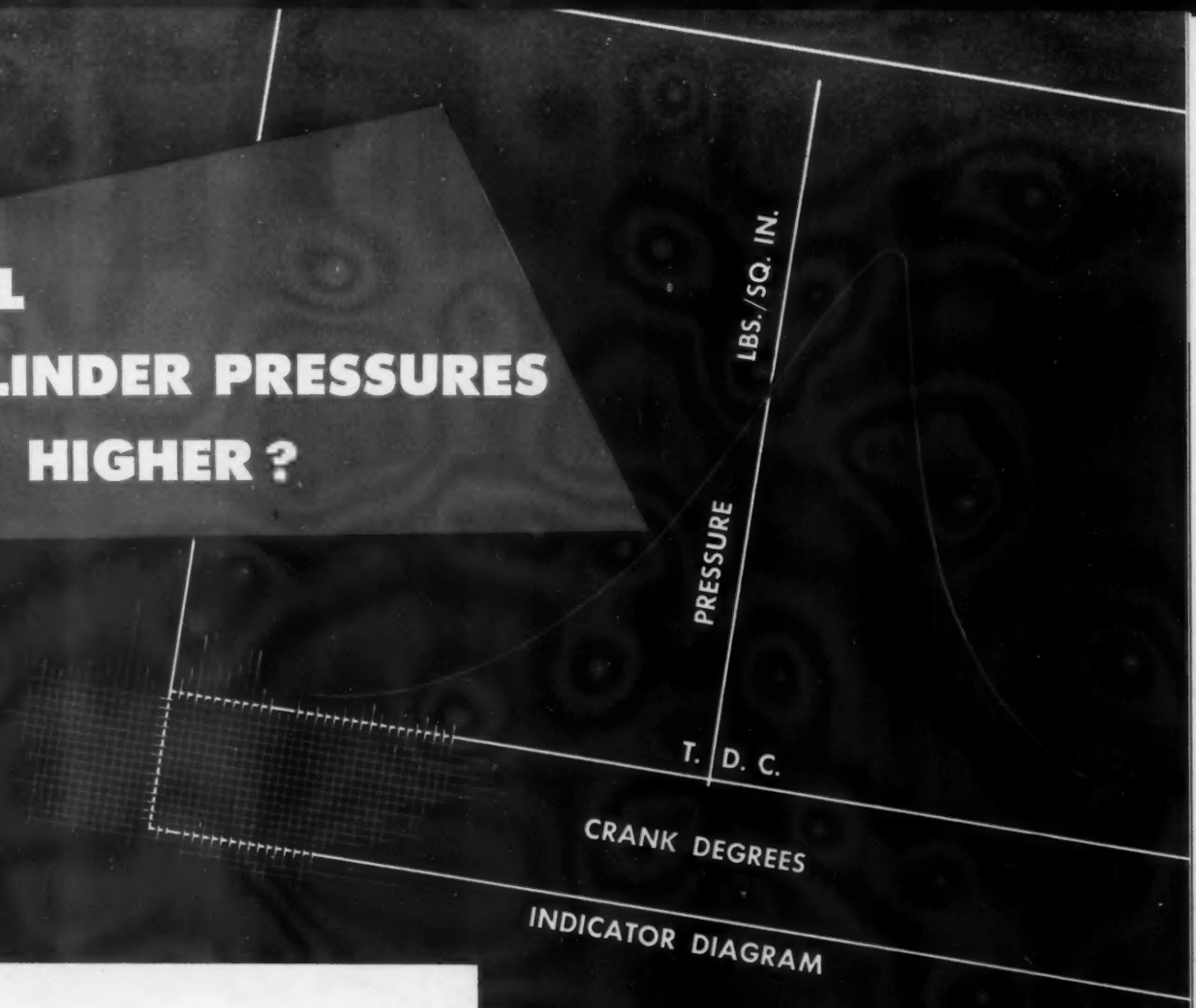
If you have a sealing problem, send the details with a print of the assembly to Armstrong. Armstrong's engineers can supply the right materials for thousands of sealing jobs. They will also be glad to give you technical information about any of the other materials listed below. Write to Armstrong Cork Co., Industrial Div., 1502 Arch St., Lancaster, Pa.

ARMSTRONG CORK COMPANY

Materials and Specialties FOR AIRCRAFT AND AUTOMOTIVE UNITS

- **Gaskets, packings, seals,** piston cups, bushings, and valve seats—for gauges, fuel lines, meters, hydraulic systems, and other equipment.
- **Composition roll goods,** with or without fabric back, plain or adhesive-coated—used as glazing strip, binding tape, cushion pads, anti-skid flooring, and gaskets.
- **Tank strap cushions**
- **Sealing materials** for specialized aircraft equipment handling aromatic fuel.
- **Felts** for vibration-damping and soundproofing
- **Wingwalk materials**
- **Resilient floorings**
- **Carburetor floats** and other fabricated natural or composition cork specialties.

WILL CYLINDER PRESSURES BE HIGHER?



• Increased compression ratios, greater efficiency resulting from new fuels and improved combustion chamber design, may bring higher cylinder pressures. If so, other factors of engine design such as pistons, cylinders, engine speed and heat dissipation must be reconsidered.

Higher cylinder pressures will also have a profound effect upon the design of certain component parts such as piston rings. They will require improved resistance to impact, wear, fatigue and heat.

The problems of increased cylinder pressures will be many and complicated, but with years of experience in the design and production of piston ring castings and finished piston rings for automotive, aircraft and industrial engines, Muskegon is already planning for the engine of the future. Expensive experimentation and research delays may be lessened or avoided by discussion first with Muskegon's engineers and metallurgists. Consult them freely.

Let's ALL BACK THE ATTACK!

MUSKEGON
Piston Rings

MUSKEGON PISTON RING CO.
MUSKEGON, MICHIGAN
PLANTS AT MUSKEGON AND SPARTA

FAMOUS LIFE LINES

WAR Ship-to-Plane Gasoline Delivery in Sicily—via the General Motors Truck "duck" shown in the background. Fuel, brake and lubrication "life lines" for tens of thousands of Allied planes, trucks, landing craft and other carriers are made of Bundy Tubing.

ACME

Irresistibly, America's might has turned the tide of war toward Victory. And American *production* will largely determine the kind of world we shall have to live in when peace comes.

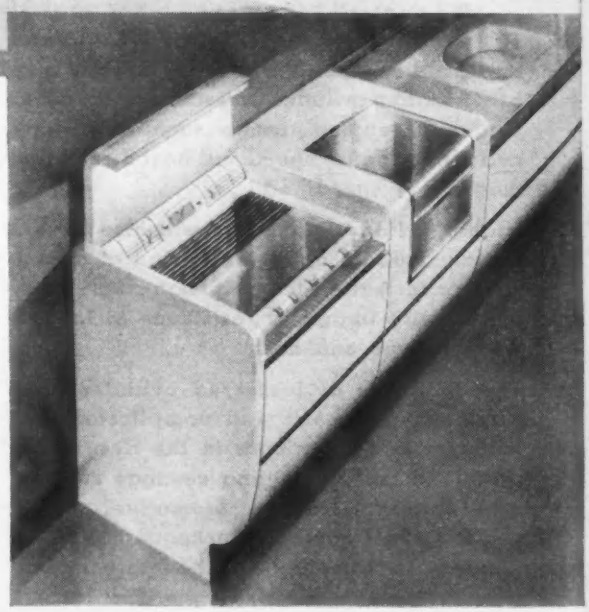
On the day of unconditional surrender, another "battle of supply lines" will begin. Again the cry will be for *speed* — speed of re-conversion, speed of manufacture, speed of transportation to carry needed goods to every corner of the earth.

Bundy, today, is supplying "life lines" of tubing for nearly 10,000 wartime applications. Our production capacity has greatly increased—and hundreds of new tubing uses have been developed for the peace years ahead.

Are you, like Bundy, planning for that time? Have you considered how tubing can be used to improve your post-war products, and cut their cost? Bundy engineers are ready *now* to help you in your planning. For information, write Bundy Tubing Company, Detroit 13, Mich.

BUNDY TUBING

ENGINEERED TO YOUR EXPECTATIONS



PEACE This Sketch by Robert E. Bingman, widely known Detroit engineer and industrial designer, gives a hint of the pleasant surprises which housewives may expect in their "gas ranges of tomorrow." Whatever their design, Bundy Engineering and Research stand ready to contribute to their beauty and efficiency with "life lines" of Bundy Tubing.

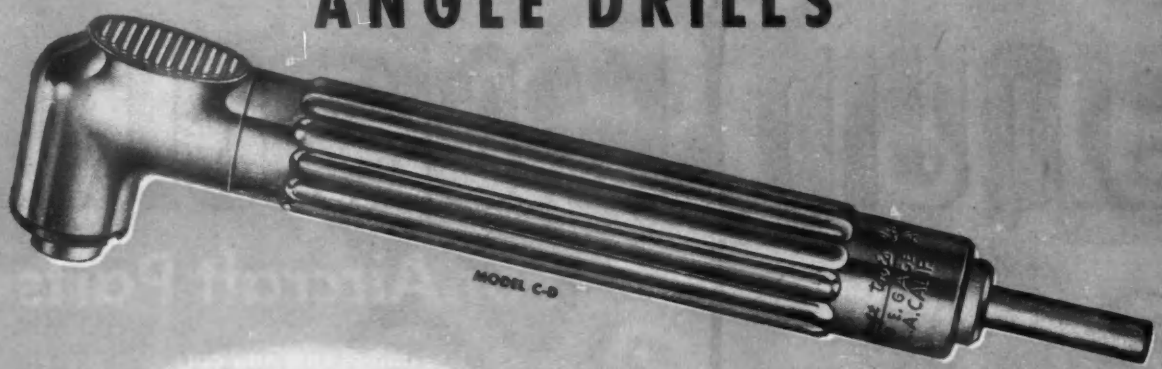
BUNDYWELD double-walled steel tubing, hydrogen-brazed, copper-coated inside and outside. From Capillary sizes up to and including 5/8" O. D. This double-walled type is also available in steel, tin-coated on the outside, and in Monel.

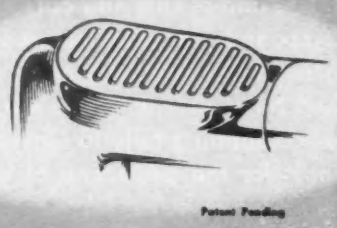
BUNDY ELECTRICWELD steel tubing. Single-walled — butt welded — annealed. Available in sizes up to and including 5/8" O. D. Can be furnished tin-coated outside in smaller sizes.

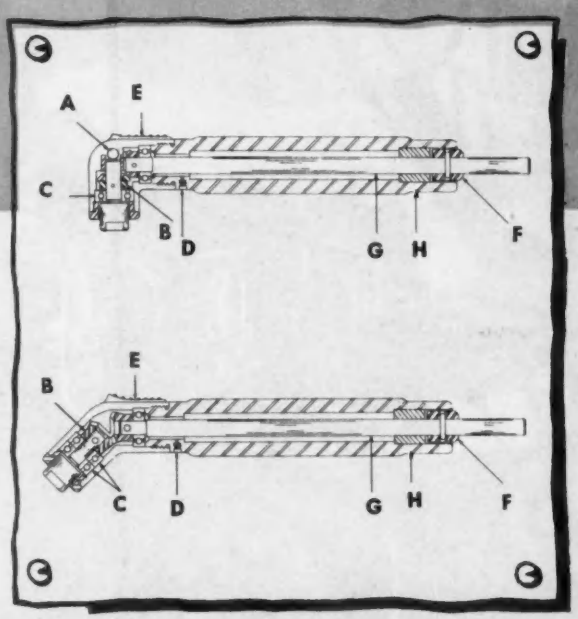
BUNDY "TRIPLE-PURPOSE" tubing. Double-walled, rolled, from two strips, joints opposite, welded into a solid wall. Available in all Monel; all steel; Monel inside—steel outside; Monel outside—steel inside. Sizes up to and including 5/8" O. D.

Aircraft TOOLS

NEW KOOL-RUN "THUMB PAD" ANGLE DRILLS







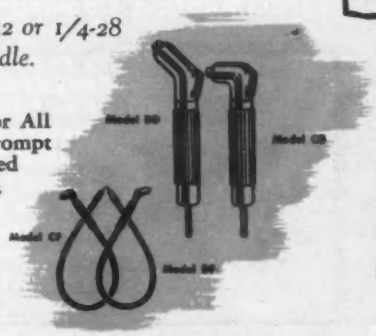
They're new from inside out and embody many exclusive features such as Thumb Pad for safe, comfortable operation, radial ball bearings for cool smooth running performance and precision construction so that all parts are interchangeable. Materials and workmanship are of the finest, insuring long life and trouble-free operation.

The direct drive Kool-Run Thumb Pad Angle Drills have thrust collars in the back end to prevent gears from creeping up and wearing.

Available with either 10-32 or 1/4-28 threaded nose spindle.

Complete Repair Service for All Types of *Aircraft* Tools. Prompt Attention by Experienced Craftsmen!

Please write on company letterhead for *Aircraft* Tools catalog.



A—Steel nose thrust ball takes all drilling thrust.

B—Heat Treated steel gears, precision fitted for cool running and long wear.

C—Precision ground radial ball bearings absorb all radial thrust.

D—Grease hole for easy, complete lubrication.

E—Built-in thumb pad for safe comfortable operation.

F—Hardened Thrust collar prevents creeping of drive shaft.

G—Heat treated shaft, precision ground for smooth running and long life.

H—Polished nickel finish and ribbed for improved grip.

Available now on priority — soon to all industry.

Industrial Division

REG U S PATENT OFFICE

Aircraft TOOLS, INC.

750 E. Gage Avenue, Los Angeles 1, California

LIQUID PACKAGING

For Aircraft Parts

A complete line of rust and corrosion preventive compounds is manufactured by R. M. Hollingshead Corporation a major supplier for Army and Navy aircraft. There are WHIZ compounds—conforming fully to Government specifications—for the protection of internal and external surfaces.

Applied to plane parts and weapons by spraying, swabbing, or dipping—depending on type—this "liquid packaging" eliminates the risk of rust and corrosion from factory to battle-line . . . is easily, quickly removed—*if* removal is required.

Your inquiries about these protective compounds will receive prompt attention. Our engineers are ready to work with your engineers in designing special chemical products to meet your particular needs. *R. M. Hollingshead Corporation, Camden, N. J., Toronto, Can.*

Also makers of Whiz Hydraulic Fluids, Compounded Lubricants, Lubricating Oils, and Cleaning Compounds for aircraft.

WHIZ RUST PREVENTIVE COMPOUNDS
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WHIZ AIRCRAFT PRESERVATIVE COMPOUND
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WHIZ RUST PREVENTIVE COMPOUND
(Paralketone Type)
WHIZ CORROSION PREVENTIVE COMPOUND
(For Aircraft Engines and Parts)
AND OTHER SPECIAL COMPOUNDS

Whiz

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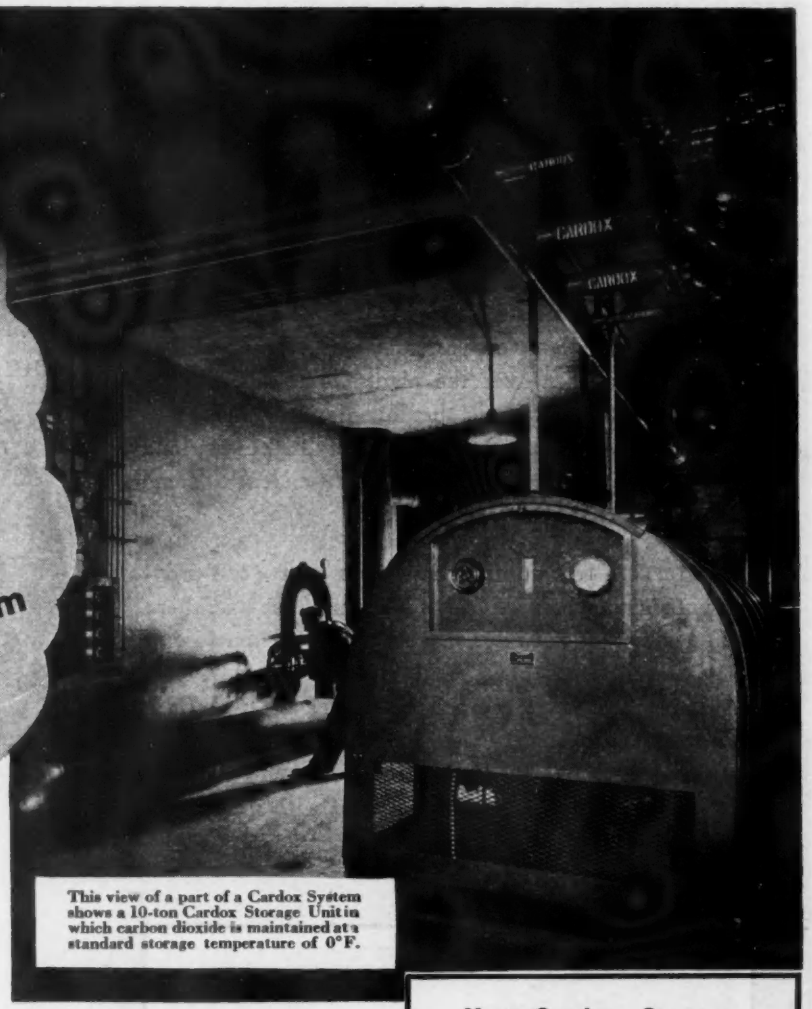
LEADER IN MAINTENANCE PRODUCTS

BUY MORE WAR BONDS AND STAMPS NOW!

Tough Fire Hazards "Engineered" this CARDOX Fire Extinguishing System



This view of a part of a Cardox System shows a 10-ton Cardox Storage Unit in which carbon dioxide is maintained at a standard storage temperature of 0°F.

Hazards in this plant involve the extensive use of flashy flammable liquids. Unless extinguished in a few seconds, fire could mean the total loss of precious materials and skilled man-hours.

Protection for these hazards is provided by a Cardox System . . . individually engineered to give the most effective application of Cardox CO_2 for the specific hazards protected by the system.

How This Cardox System Performs

Fire in any of these hazards is detected visually or automatically.

An alarm sounds, giving personnel notice to leave the fire zone. Time is allowed for complete evacuation of personnel.

A timed mass discharge of cold Cardox CO_2, released into the fire zone, reduces oxygen content of the atmosphere below combustion requirements and cools out the entire fire. So rapidly is the Cardox CO_2 discharged into the fire that burning time is usually cut to a very few seconds.

Since Cardox CO_2 is a non-damaging, non-contaminating inert gas, there is no damage or production delay caused by the extinguishing medium.

How Cardox Systems Provide Uniform Performance

Extinguishment of this kind is possible with a Cardox System, through engineered application of carbon dioxide maintained at a standard storage temperature of 0°F. Cardox CO_2 extinguishing performance is uniform, regardless of weather or plant operating temperature.

The advantage of uniform extinguishing performance can thus be provided in small or large systems, whether engineered for one or a number of hazards —indoors or out.

Convenient hose reels can be included in the system for fire that would call for local direct application of Cardox CO_2. For example, loading or unloading volatile and flammable liquids.

If you would like more information to help solve war plant fire protection problems of today . . . or in perfecting post-war plans for reducing loss of property and life by fire—write for Bulletin 424.

★ ★ ★

CARDOX CORPORATION
BELL BUILDING • CHICAGO 1, ILLINOIS

District Offices in New York • Washington
Detroit • Cleveland • Atlanta • Pittsburgh
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How Cardox Systems Protect War Industries

- Timed discharges, as needed, through built-in piping systems . . . supplied instantly from a single storage unit holding tons (if required) of liquid Cardox CO_2.
- Mass discharge of Cardox CO_2 "knocks out" fire, by . . .
- Reducing oxygen content of the atmosphere below the concentration necessary for combustion, and . . .
- Cooling combustibles and fire zone below ignition temperature . . .
- Extinguishing fire quickly and completely *without* damage from extinguishing medium.

CARDOX—CO_2 Systems with Enhanced Fire Extinguishing Performance

A. Uniformity of CO_2 characteristics.
B. Extinguishing medium with uniformly greater cooling effect.
C. Accurate projection of CO_2 through greater distances.
D. Timed discharges, as needed, through built-in piping systems . . . supplied quickly from a single tank holding tons of liquid Cardox CO_2.

ENHANCED COOLING EFFECT
CENTRAL STORAGE UNIT
AMPLE CO_2 RESERVE
ENGINEERED SYSTEMS
MANUAL AUTOMATIC

CARDOX

NON-DAMAGING FIRE EXTINGUISHING SYSTEMS

Yesterday—*Only true pioneers and thrill seekers would ride in the rickety "egg crate" plane. Yet that plane, with all its crudities, was a giant step in human progress and transportation. Without early abrading, processes such as grinding, it would have been impossible.*

Today—The giant air liner is a tremendous improvement on the plane of yesterday—as is the modern fighter or bomber over the planes of World War I. HONING—the advanced abrading process—helped to make this improvement possible. Safety, lightness, long operation without overhaul—all are dependent to some degree on HONING.

Tomorrow—We do not know what course the progress of air transport will take. But whatever it is, there will be greater need for better controlled machining processes.

Micromatic has developed the HONE ABRADING process to be ready for these advanced requirements. At present, HONING application is limited to serious war needs. Tomorrow, it can expand with many new applications already developed.

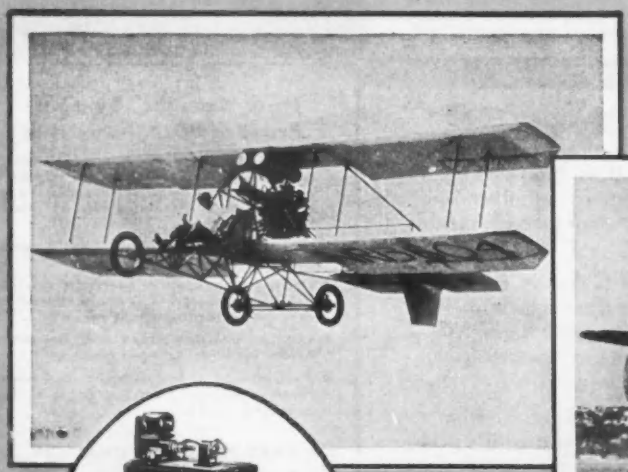
HONING

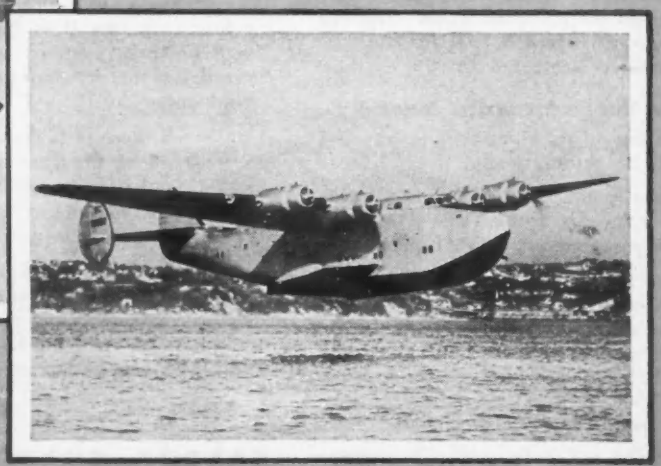
helped to develop yesterday's

'EGG CRATE' Plane

into the

SAFE, MODERN AIR TRANSPORT





Micromatic HONE CORPORATION

Detroit, Michigan

MAKERS OF HONING MACHINE TOOLS

HONING helped create "400" Aviation

The tactical need for outflying our enemy has crowded military aviation into the "400" bracket, as may be seen in the comparison below:

	WORLD WAR I	WORLD WAR II
Speed	130 MPH	400 MPH
Period Between Engine Overhauls	40 Hours	400 Hours
Tactical Ceiling	12,000 Feet	40,000 Feet
Engine HP	125 HP (Liberty)	2,000 HP

This amazing advancement has been accomplished largely by better engineering design, better metallurgy and better controlled machining. Microhoning provides one of the most important machining controls by assuring maximum quality and safety in the bearing surfaces of our military and naval plane engines and other plane mechanisms.

Bearing bores and other critical surfaces are finished by Microhoning—the modern abrading process which removes stock at rates up to 65 cubic inches per hour, generates accuracy for roundness and straightness of bore within .0002" to .0003" and any desired surface finish.

Better planes for war mean better planes for the peace to come.

Some Microhoned Aircraft Bores

Engine Cylinder Barrels

Master Con Rod (all bores)

Articulated Rod (all bores)

Piston Pin Bores

Valve Guide Bores

Pinion Gear Bores

Oleo Cylinder Bores

Brake Cylinder Bores

Gun Turret Hydraulic Cylinder Bores and many other parts

MICRO MATIC

MICROMATIC HONE CORPORATION

DETROIT, MICHIGAN

PEDRICK PRECISION *rings the bell!*

WHEN PORTABLE COMPRESSORS PLAY VOLUNTEER FIREMAN . . .

● Among the many roles played by portable compressors in this global war, is fire-fighting. Even the most isolated posts get quick and dependable relief from fires kindled by enemy raids because these units draw water from any source and deliver a strong, steady stream to the flames.

In many of these compressors, dependability is assured by Pedrick *precisioneered* piston rings. They have correct and lasting tension, absolute flatness and true shape because of Pedrick's patented processes of double-disk grinding and Heat Shaping.

Not only on innumerable war fronts, but on every home front where internal-combustion power or pressures must be kept at top efficiency in spite of overloads, over-age and over-hours, PEDRICK piston- and sealing-rings are easing the burdens of the Nation's service and maintenance men. WILKENING MANUFACTURING CO., Philadelphia and Scranton, Pa. *In Canada:* Wilkening Manufacturing Co. (Canada), Ltd., Toronto.

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Engines are the heart of power. Never before was it so important to keep your engines operating at peak efficiency, and this calls for the best parts and proper service work. One sure way to get the piston rings that have correct and lasting tension, accuracy, flatness, fit, quick seating, and long life so necessary to superior performance is to specify Pedrick *precisioneered* piston rings. Write for our latest catalog and installation information.

KEEP ON BACKING THE ATTACK WITH WAR BONDS

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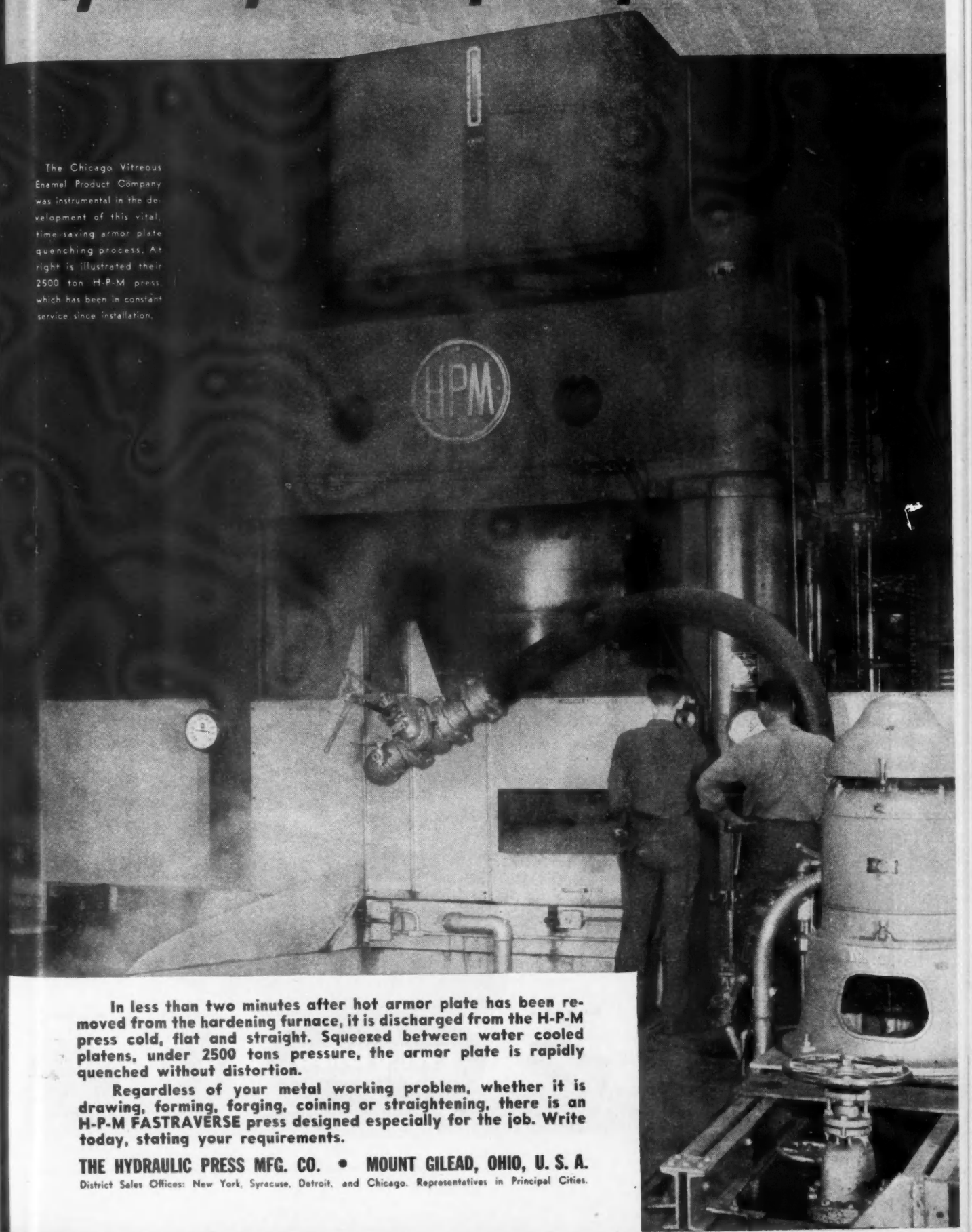
H·P·M FASTRAVERSE PRESSES
speed up armor plate production

The Chicago Vitreous Enamel Product Company was instrumental in the development of this vital, time-saving armor plate quenching process. At right is illustrated their 2500 ton H-P-M press which has been in constant service since installation.



In less than two minutes after hot armor plate has been removed from the hardening furnace, it is discharged from the H-P-M press cold, flat and straight. Squeezed between water cooled platens, under 2500 tons pressure, the armor plate is rapidly quenched without distortion.

Regardless of your metal working problem, whether it is drawing, forming, forging, coining or straightening, there is an H-P-M FASTRAVERSE press designed especially for the job. Write today, stating your requirements.

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When THE HEAT IS ON!

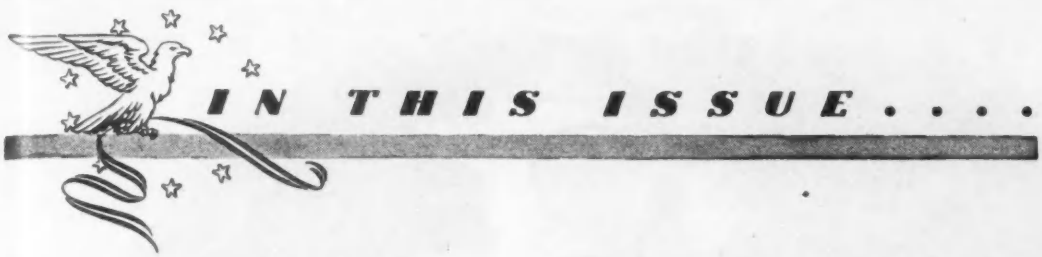
The real test of men or machines is how they react under pressure—the demand for extra effort—longer hours—harder work.

Take the friction materials used in Twin Disc Power Take-offs or the Model E Heavy Duty Clutches for example. Some materials just can't take it "when the heat is on" . . . the necessary frictional heat which is generated as the clutch is engaged—and the materials disintegrate quickly. That's why Twin Disc developed their own testing equipment to really "put the heat on" various friction materials. The result was the perfection of friction discs which are highly resistant to failure "when the heat is on." At the same time the materials selected must assure a clutch which will take hold smoothly without grabbing—grip firmly and surely without slipping when fully engaged.

More than a quarter of a century devoted to perfecting clutch details, like this, assure the reliable performance and longer work-life of Twin Disc Clutches. This specialized experience has given the Twin Disc Clutch Company a fund of information which is yours for the asking when you have any problem requiring a link between driving and driven units. TWIN DISC CLUTCH COMPANY, Racine, Wisconsin (Hydraulic Division, Rockford, Illinois).

Top: Power Take-off. Single or two-plate toggle-action clutches.

Bottom: Twin Disc Model E Clutch, built to stand heavy shock loads under the most exacting service.



AUTOMOTIVE and AVIATION INDUSTRIES

Volume 90 February 15, 1944 No. 4

Shifting War Conditions Present Many Problems 17

Among 33,000 new car and truck dealers there are many perplexing problems that seem to baffle solution. Still they are all looking forward to the future with confidence. Here is an account of the situation as it stands today and what is being done.

Production of the Gyro Compass 18

Here is an account of accomplishments that is unusual. Just how the Dodge Division of the Chrysler Corp. got into the big figure production of so intricate a device and one so foreign to their previous experience is well worth reading about.

Metal Propeller Blades Precision Rolled 22

An automatic rolling mill for taper rolling thrust and camber steel plates accurately and with a saving of material and manpower is described in this article. The technique is markedly different. Read about it.

Technical Developments in Aeronautics 26

Out of the annual meeting of the Institute of the Aeronautical Sciences came a wealth of data. Many of the top-flight men in the industry contributed. Here are some of the highlights that should prove educational.

Enemy Vehicles 30

The war vehicles that our fighting men are meeting on the front lines. They are all described and the text is liberally augmented by illustrations.

Flying Boat Loading Instrument 38

This system makes use of an automatic weight and balance indicator that does all of the figuring and almost all of the thinking. It is an interesting development.

AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.

With Emphasis on Production

By Julian Chase

THE largest estimates of the number of Americans who, at some time or times sooner or later, will be thrown out of war work and must be absorbed by peace-time operations range up to 25 and 30 million. On the other hand, the Brookings Institution has estimated that reasonably full employment can be attained at the end of a transition period of approximately two and one-half years by the addition of eight million workers to the number employed in 1940, for a total employment, then, of 54 million.

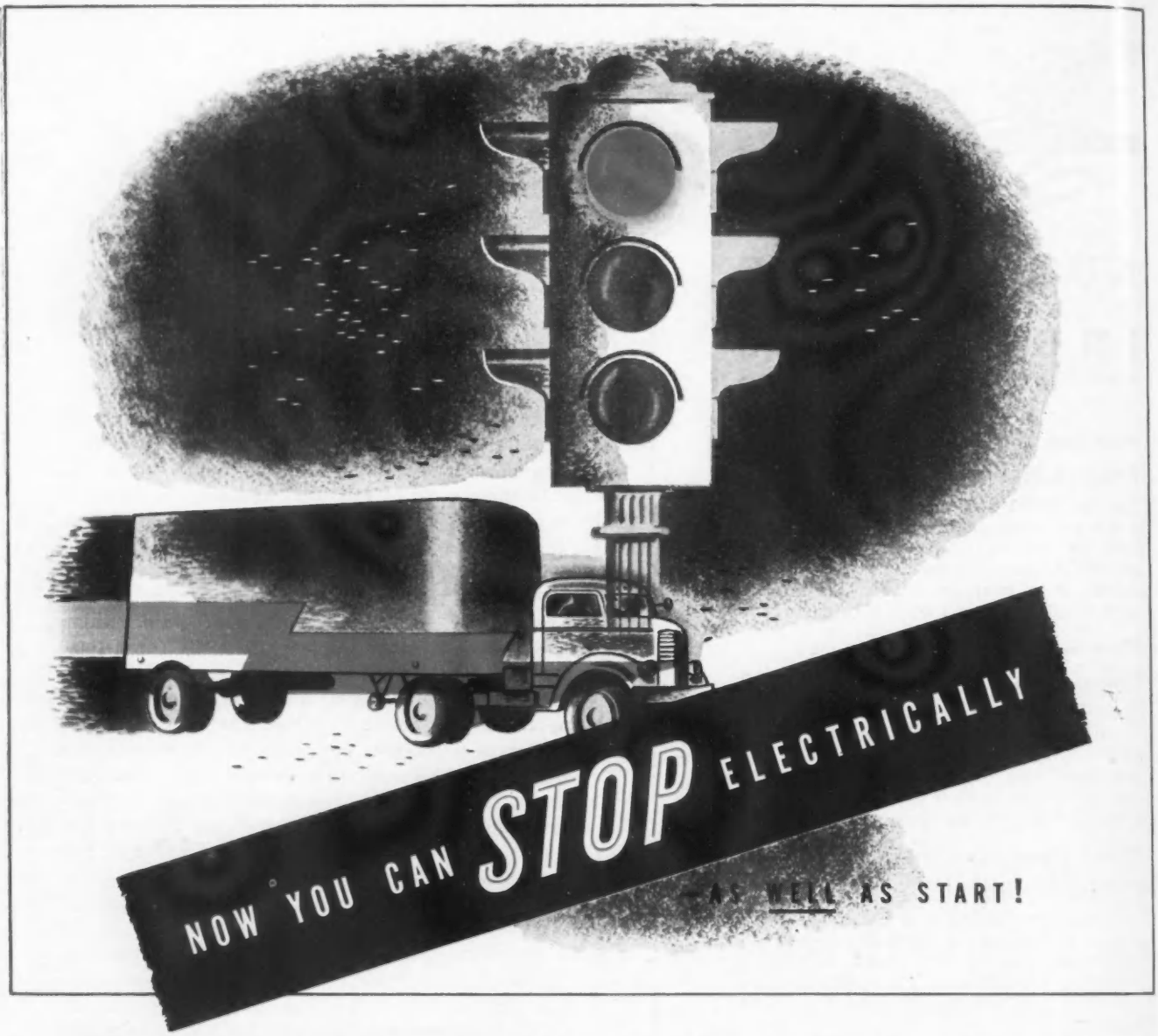
The problem before us is not merely one of finding wage-paying jobs for this or that number of persons. The primary problem is one of getting increased production of peace-time goods, by far the biggest increase in production we have ever seen, from whatever number are employed. In no other way can we keep our economy functioning with full effectiveness under the tax load that it will have to bear.

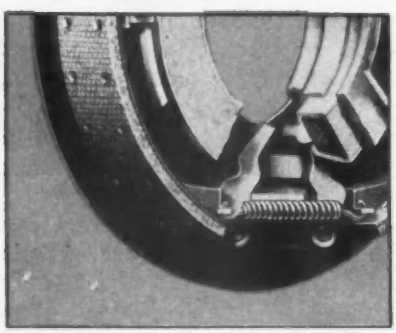
From 1900 to 1941 there was an increase of 88 per cent in the number of those gainfully employed. In the same period our national income paid out, according to Conference Board figures, increased 457 per cent. That is at an average rate of less than 4½ per cent per year. On a per-person-employed basis national income rose during those 41 years from $590 to $1,752.

A national income of 150 billion with 54 million workers is equivalent to $2,777 per person employed, which is at least a rough indication of the extraordinary increase that must be developed per individual in the value of production, services, and other things which go to make up national income.

So far as offering any sound indication of potentials in this respect, the years 1942 and 1943 are of little help. They show us that production can be markedly stepped up but, when values are being considered, they are misleading. It must be kept in mind that the law of supply and demand has largely been suspended for the duration.

Will the job be done? Much will depend on taxation, price and wage trends and on the attitude of government toward labor and industry. In no small degree, says the Brookings Institution, will the accomplishment of the job depend on the restoration of confidence in the future of the free enterprise system and effective cooperation between government and the private economy.





MUEHLHAUSEN SPRINGS PREVENT FROZEN BRAKES

AS applied to motion, electricity has been considered generally as a starting and moving force—but now, with Warner Electric Brakes, it is used for stopping as well.

This brake has another thing in common with many other products—the use of well-engineered springs to control important mechanical actions. Warner relies on Muehlhausen Springs to free the brake bands after the vehicle has slowed or stopped. On one grueling run after another, through heat, rain and crystallizing cold, Muehlhausen Springs perform this job automatically.

A big responsibility for a little spring! But, because of careful design by experienced engineers, it does its job unfailingly.

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Leading product designers in every industry are consulting Muehlhausen Engineers to secure springs of lasting efficiency.

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SPRINGS
EVERY TYPE AND SIZE

AUTOMOTIVE and AVIATION INDUSTRIES

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February 15, 1944
Volume 90, No. 4

Shifting War Conditions

Present New Car Dealers With Many Problems

By E. L. Warner, Jr.

AUTOMOBILE dealers of the country, with almost two years of new car rationing behind them and no prospect for the resumption of passenger car production in the immediate future, are looking forward, nevertheless, to the day when they again can take up the competitive sales of motor vehicles free from Government regulation. Despite the war, there are still more than 33,000 new car and truck dealers in business as of Jan. 1 compared to 40,537 at the end of 1941, a decrease of approximately 21 per cent. War's attrition upon the dealer body has not been as great as many gloomily predicted two years ago when the nation's supply of 520,000 new cars was frozen in order to distribute them to the most essential users.

The postwar market for passenger cars looks like a bonanza for the automobile dealers, being variously estimated at from eight to twenty million vehicles, depending upon the degree of optimism expressed by the estimator. However, there are a good many hurdles that must be negotiated before the dealers arrive in the sellers' paradise that is freely predicted after the war is won. David E. Castles, of St. Louis, retiring president of the National Automobile Dealers Association, warned the recent annual convention of that organization at Detroit that there is as much danger of overoptimism now as there was of overpessimism at the association's last previous convention early in 1942.

Greatly increased repair and maintenance business, used car sales and a larger unit profit on new vehicle sales, together with some economies, have enabled the large percentage of dealers to survive two years of war. Financial relief for automobile dealers was provided under the terms of the Murray-Patman Act of May 12, 1942. This act permitted dealers to borrow from RFC or its subsidiaries on their stocks of rationed commodities. Such loans are due to mature April 30 unless extended by RFC.

Likelihood of the dealers having new passenger cars to sell in 1944 appears remote. Barring a sudden collapse of Germany, the resumption of passenger car manufacturing this year is regarded as very improbable. Government officials have adopted a policy of discouraging discussion on the pospects of reconversion and resuming civilian production except on a small scale. The tightening situation with respect to passenger car tires is an important limiting factor to the early resumption of car production. Availability of tire cord needs improvement, while produc-

(*Turn to page* 70, *please*)

AN immediate problem confronting automobile dealers is the diminishing supply of new and used cars. It is estimated that as of Jan. 1 there remained only 60,000 new passenger cars in dealer stocks throughout the country. As used car stocks continue to decline, there is threat of a car price ceiling and used car rationing by OPA. The NADA is opposed to such restrictions and recently pointed out to OPA the unfortunate effects of the price ceiling placed April 26, 1943 upon used trucks. The used truck price ceiling has driven the used truck business out of the hands of legitimate dealers into individual black market deals. A NADA survey showed that as little as 8 per cent of the used truck business in a number of states remained in the hands of legitimate dealers. Many used trucks thus pass from owner to owner without proper servicing and reconditioning, while others have been taken out of service by their owners rather than sold at the ceiling prices imposed by OPA.

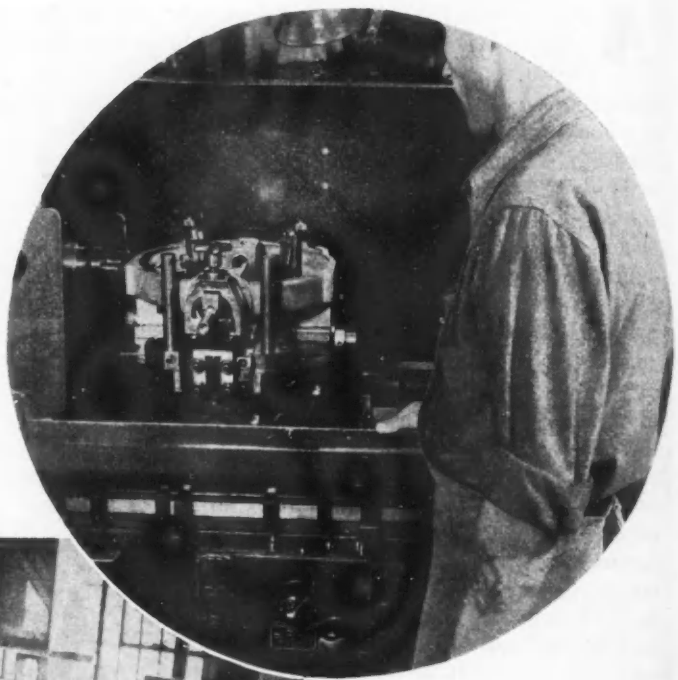
Quantity Production of Gyro

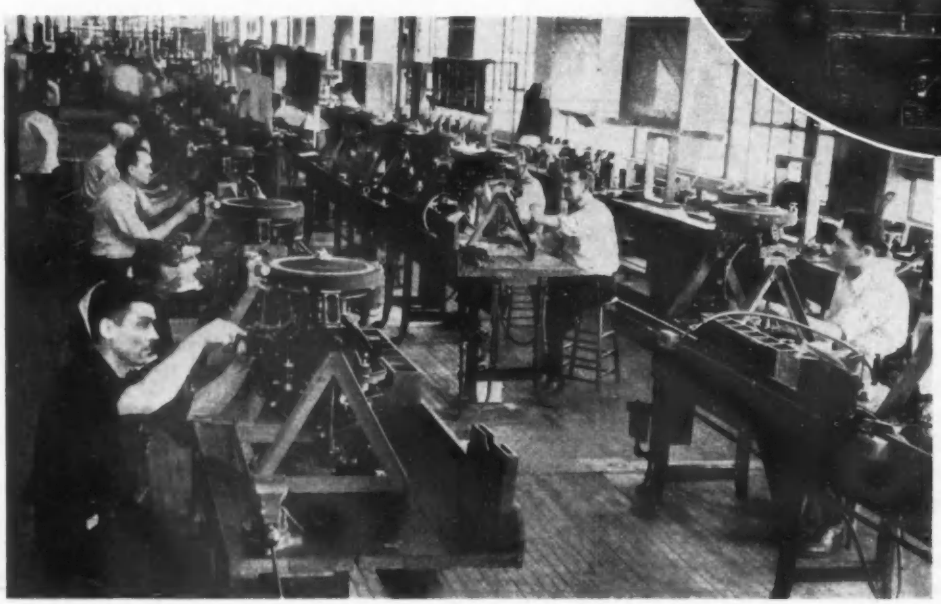
"THEY said it couldn't be done ——." But the Navy asked Chrysler Corp. to produce much-needed Sperry gyro-compasses in large volume, compared with peacetime requirements, and it agreed to do so. Eventually, this unusual project with its intricate mechanism, encompassing some 10,000 parts for the assembly, was handed to the management of the Dodge Div., Chrysler Corp., which was to work on its execution with any aid it needed from centrai management.

Traditionally, it has been thought that an organization strange to the art would need several years of preparation and training before it could cope with the manufacture of the gyro. Moreover, it was believed that the exacting operations could be handled only by seasoned toolmakers. Dodge had neither to offer. But Chrysler Corp. had the know-how of mass production and a management skilled in automotive manufacturing. Suffice it to say that with the cooperation of the Sperry organization in providing the necessary blueprints, specifications and technical information, Dodge Division produced its first two gyro-compasses within six months. And shortly after that time was ready to plunge into quantity production.

Owing to the scarcity of labor at this critical stage of the war program, the workers in the gyro department were recruited from fields quite foreign to this type of work — principally from the Dodge trim, paint and body in the white shops, and the pressed steel and final assembly line departments. In fact, no other type of labor was available. It was reasoned that since the gyro-compass would be built in mass production for the first time and that since handicraft alone would not produce sufficient volume, the best plan would be to develop techniques and jigs and fixtures and machine set-ups similar to those used in automobile production that could turn out the job mechanically. And that's how it was done.

At the outset the instrument was broken down into logical sub-assemblies for systematic production routing. Some 200 high precision machine tools of latest type were ordered and then the master mechanic's department undertook the design and procurement of some 5000 items of tools, jigs, dies, fixtures, etc., to place each task on a purely mechanical basis.





(Circle) Close-up showing precision-boring of phantom ring bearing holes

(Left) View in the assembly department, steps in the assembly of the sensitive element.

Compass

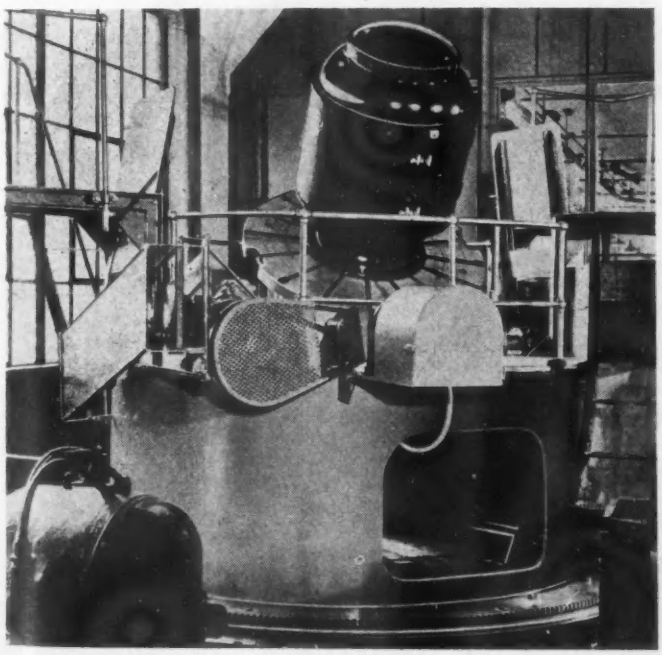
at Dodge Plant

By Joseph Geschelin

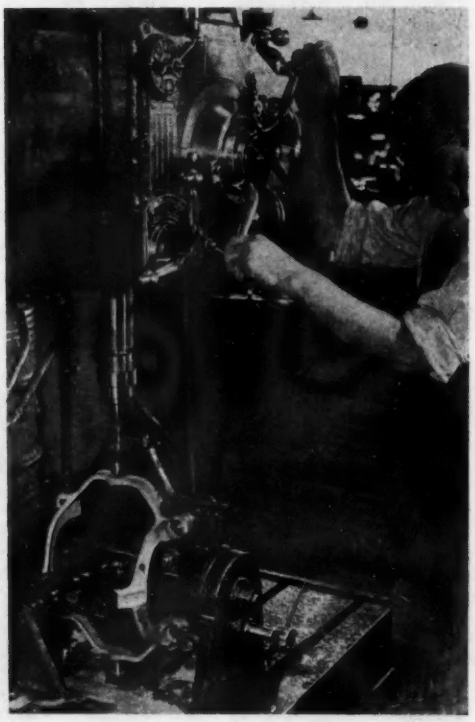
For this program it was decided to produce only the major critical elements of the assembly. The remaining small parts, fabricated sheet metal, and fastenings, as well as the specialized electrical equipment, were subcontracted by drawing on a group of some 350 suppliers. Dodge's new aluminum foundry, which was just getting under way about that time, was given the job of making the delicate aluminum castings.

Following the precepts of automotive practice, gyro production was centralized in one department, on one floor, providing a straight-line produc-

(Above) "Relation" gages, specially designed by Dodge, are employed for the inspection of major parts, particularly intricate pieces such as the ballistic frame. These fixtures check the relation of all control points simultaneously.



(Above) Scorsby testing machine, used by Navy Inspectors to check the behavior of the gyro-compass under conditions of simulated roll, pitch and yaw.



(Right) Delicate ballistic frame casting is firmly secured in a massive fixture to assure proper alignment in drilling.

tion process, starting with raw materials and purchased parts at one end and progressing through assembly stages to the testing and shipping department at the other end. The watchful eye of the superintendent of this division can scan the entire operation in a matter of minutes.

Now for some impression of the magnitude of the job. The layman pictures the gyro-compass as the unit mounted in the binnacle. Actually that is the heart of the gyro but is only a part of the equipment. In addition, there are, besides the panels and other accessories, the repeater instruments. They are located throughout the vessel and are synchronized with the master compass, which is located in the hold of the ship. The fact is that it takes eleven or more large individual packing cases to ship one gyro.

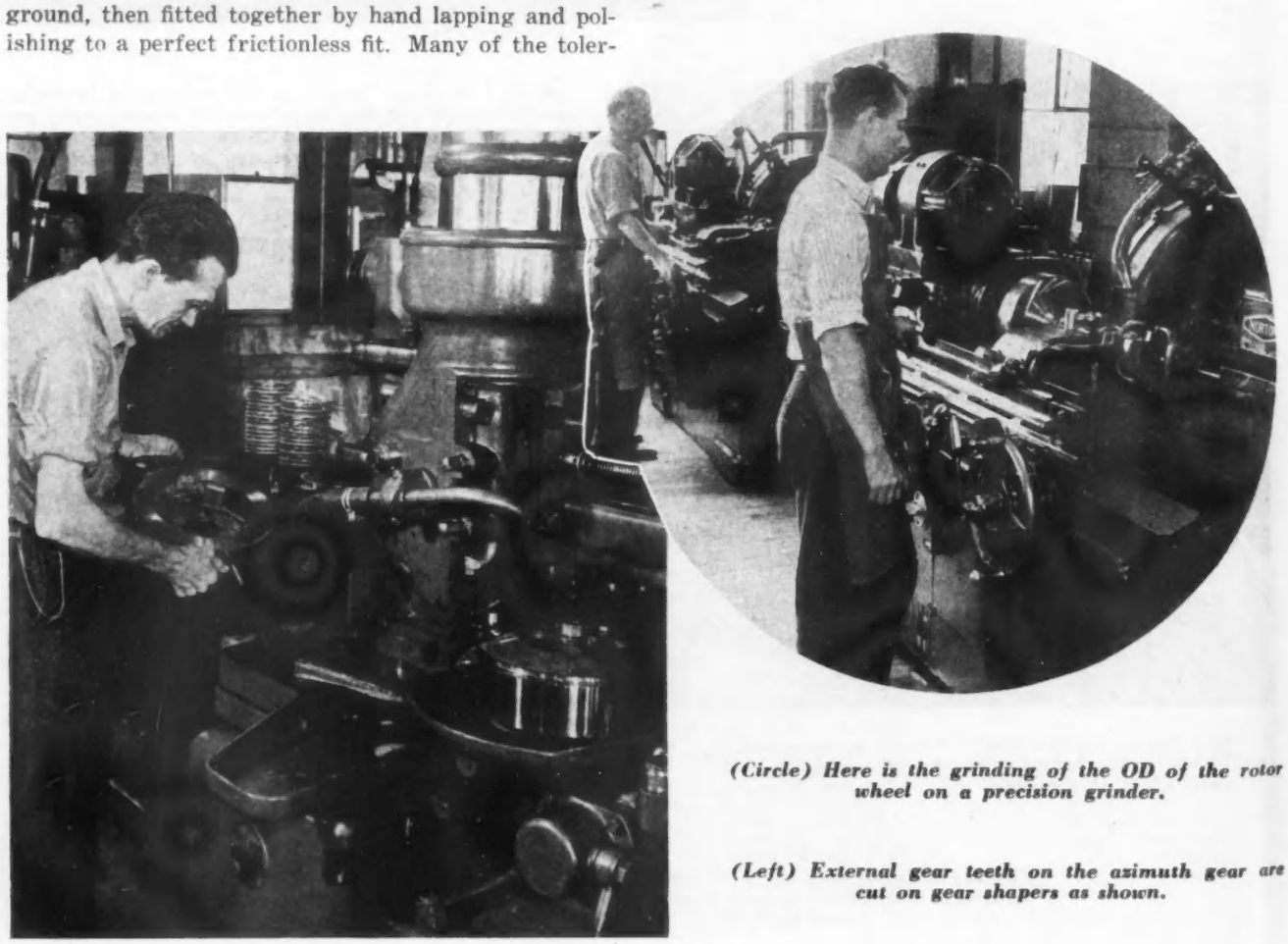
Building the gyro is unquestionably a problem of major proportions. You can use painstaking care in the machining and fitting of individual parts and in the integration of sub-assemblies but when put together, the gyro may not necessarily point North. Yet that's what you want it for.

Precision is the watchword. It's a problem of achieving zero balance without friction which is almost like making the East and West meet. The tiny ball bearings have no looseness but must turn effortlessly. The rotor assembly, spinning at 6000 rpm, is balanced to 0.01 oz. in., and is so smooth running that a thin dime can be balanced edgewise on the case without tipping. We saw this demonstrated. The small components of the "corrector" assembly are machined and ground, then fitted together by hand lapping and polishing to a perfect frictionless fit. Many of the tolerances on bores and diameters are held to 0.0002 in., boring being done in a battery of precision boring machines. Some of the major parts begin as delicate aluminum castings in the form of spiders. They have to be handled carefully and stress-relieved before finish-machining.

One such part—the Azimuth Gear—is of irregular shape and is made of a tough bronze alloy. In consequence, conventional methods of heat treating were not satisfactory in removing internal stresses completely enough to assure accuracy of alignment. After various experiments, Dodge decided to freeze the part rather than heat it. Now the azimuth gear is frozen to minus 120 F for three hours, after rough machining. And that does the trick.

Another point of interest is that cemented-carbide tools are employed on practically 90 per cent of the metal cutting jobs, as well as on the precision boring machines. That has made it possible to speed up the cutting of bronze and aluminum and cast iron while at the same time producing an excellent surface finish.

Getting to the details of the production operations, we find that the gyro department has been logically sub-divided in a progressive routing of the various stages of manufacture. First is the lathe department with its complement of vertical turret lathes, turret lathes, screw machines; then a milling machine department; grinding and precision-boring department; drilling department; lapping, polishing and hand fitting. Threads are milled or precision-ground as the case may



(Circle) Here is the grinding of the OD of the rotor wheel on a precision grinder.

(Left) External gear teeth on the azimuth gear are cut on gear shapers as shown.

be. Then comes the inspection department with its interesting forms of "relation" gages which scan every critical dimension having to do with interchangeability and assembly alignment. These can best be appreciated by examining the illustrations.

Next in line is inspection for the many items of special electrical equipment secured from outside vendors. Then comes the wiring harness department. This handles, essentially, bench operations for making up the mass of cables and connectors and harness assemblies. Unique feature here is the wiring harness fixture in which each lead is identified, electrically, permitting the terminals to be marked for the proper connections at assembly.

Now we reach the initial assembly stages. First is the sub-assembly for the rotor suspension, then rotor assembly, and finally the sub-assembly of the rotor and its suspension. After an endurance run of 18 hours, the rotor and case unit is assembled into the vertical ring, carefully balanced and suspended in the Master Compass. When the compass is completed it is assembled into the binnacle and then receives a preliminary "cold balance." It is then sent to the Testing Department where it is started in operation, allowed to reach its operating temperature, is rebalanced "hot" and finally adjusted. One of the procedures for testing is the placing of the compass on a "swing platform" where the unit is checked for perfection of alignment and distribution of weight.

After some preliminary test runs on the scorsby machines, the compass is submitted to the Navy for their official test runs on the scorsby, where the complete unit is checked under simulated ship conditions for behavior during roll, pitch and yaw. At the same time, the accessory equipment—the repeater compasses, and other elements—are calibrated for a specific gyrocompass. (*Turn to page* 60, *please*)

(Above) Designed by Dodge, this is a typical fixture for hand-reaming of major parts, reaming of the rotor case being featured.

(Center) Close-up of latest type dynamic balancing machine employed for the rough and final balance of rotors.

(Below) Skilled craftsman is balancing the sensitive element in the binnacle assembly in preparation for final testing and acceptance.

Metal Propeller Blades

Precision Rolled

AIR supremacy in the future will require not only improved designs of aircraft and their components parts, but also advanced manufacturing methods for their mass production. The latter are especially needed in making metal propeller blades, which offer unusual opportunity for application of metal distribution engineering in their construction and the use of modern fabrication methods and equipment. It is very imperative that we shift from any obsolete methods and equipment that have been adopted due to the war emergency.

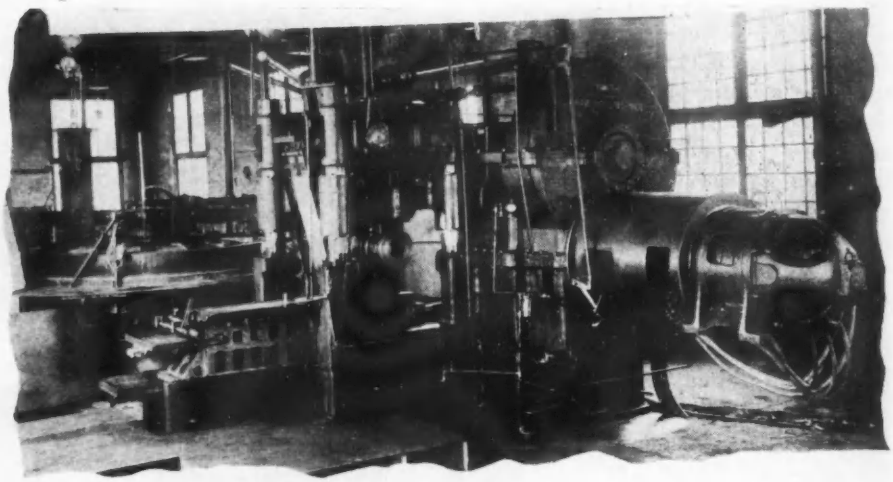


Fig. 1—Multiple pass automatic rolling mill and the 16-place rotary automatic oil furnace is at the left.

One typical expedient is the conversion of the hand mill for one-pass fabrication of the camber and thrust plates for hollow steel propeller blades. A description of this improvised method was given recently in an authoritative publication as follows:

"The old crew of eight men had grown grey in service and the old hand mill was nothing much to look at. But they hoisted it out of the boneyard, erected it where it had stood a dozen years before. Then they made the changes in the mill which the new rolling method dictated. No time had been wasted in waiting for new machinery to be built. None was needed to break in new men. The veteran hand mill crew took over.

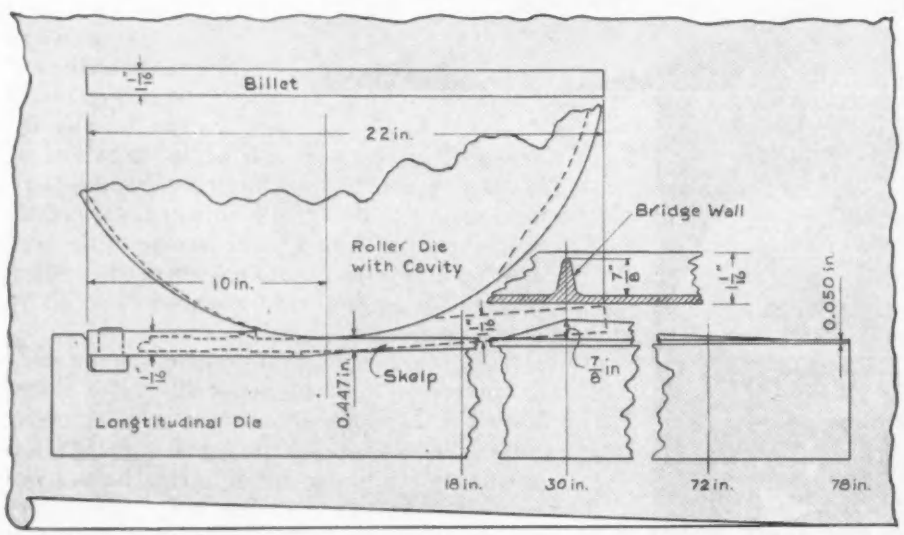


Fig. 2—Details of a 78 in. skelp as automatically rolled. Dotted lines show the 1 1/16 in. by 22 in. billet in the initial rolling position on the longitudinal die.

"The plates are about the same length and width as those made under the conventional method. They are .600 in. thick at one end point, but only .130 in. at the other. The total weight of the taper rolled plate is approximately half that of the uniformly thick plate from which steel propellers used to be made. Under the old method, half of the steel had to be machined away, sent to the scrap pile as shavings."

A modern development in this field is the automatic rolling mill for taper rolling the thrust and camber steel plates to greater precision and with a saving of material and manpower. Only one worker is necessary to

By J. W. Smith

on an Automatic Mill

A PIONEER in hollow steel propeller design, the author of this article began his work in that field over 30 years ago. During World War I he was appointed to the Steel Construction for Aircraft Committee of the National Advisory Committee for Aeronautics when it was organized and also was a member of the engineering staff at the U. S. Army air base, McCook Field, where he specialized in propeller research. His design of a hollow steel propeller, the first with separate blades mounted in a hub and with adjustable pitch, also was the first of the hollow steel blade type to pass Army ground and flight tests. This accomplishment was made possible by the application of the proper metal distribution (variable wall thickness), which he has developed further in recent years to provide a bridge wall structure that can be rolled simultaneously on the propeller plates by an automatic mill designed by him.

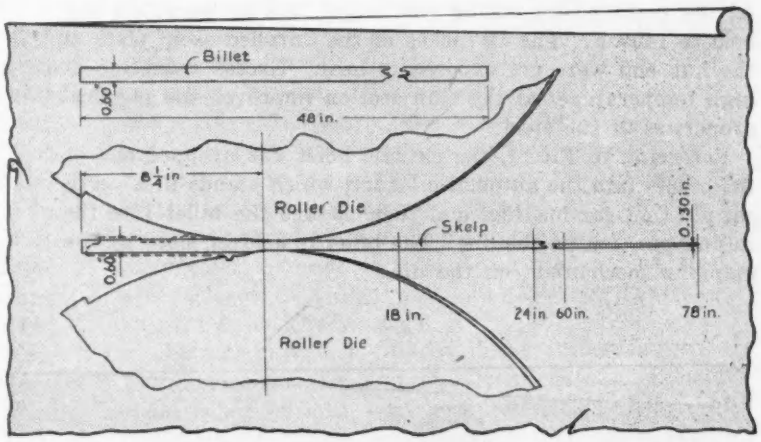


Fig. 3—The conventional hand-fed two roller mill and details of the 78 in. skelp as rolled. At the top is shown 0.60 in. by 48 in. billet as prepared for the hand mill.

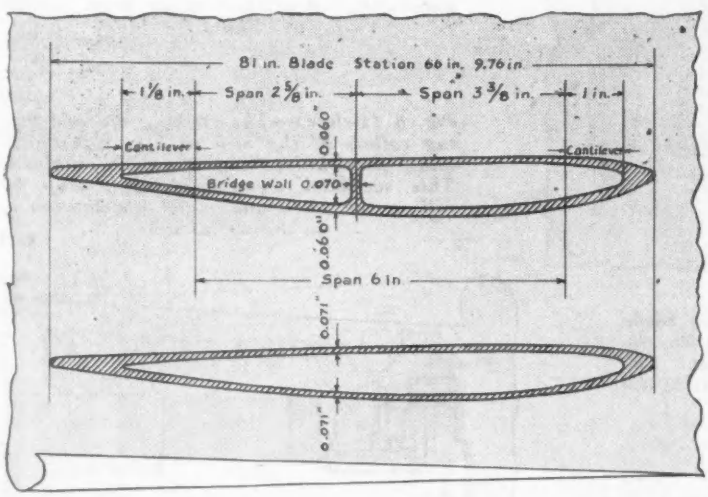


Fig. 4 (Above)—The top diagram shows airfoil metal distribution and bridge wall structure at the 66 in. station of a blade rolled on an automatic mill. At the bottom is shown the airfoil at the same station of the conventional blade rolled and machined without bridge wall, the lack of which necessitates a greater wall thickness.

operate this automatic rolling mill and loader. Steel skelp plates can be rolled for blades up to 144 in. in length, at the same time rolling in them one or two bridge walls as required to permit efficient metal distribution.

The automatic rolling mill shown in Fig. 1 was the first to taper roll 400 skelp plates for a large propeller manufacturer to demonstrate that short, one-half length plates could be taper rolled to the required plate specifications to eliminate all of the slab milling, which would save over $200,000 per month in waste material, plus the cost of the slab milling. The contract was signed on March 5, 1942, and in April, 1942, the first taper rolled plates came off this 45-ton automatic mill which has a pressure loading of up to

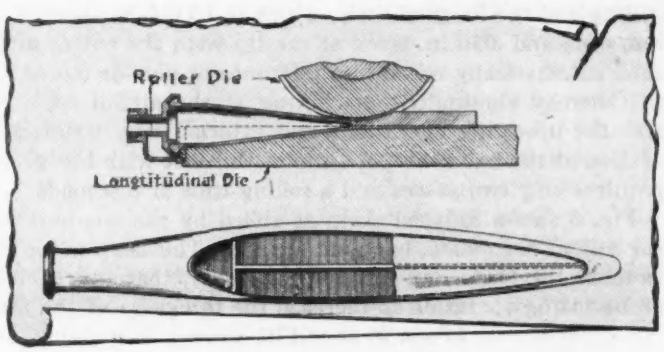


Fig. 5 (Right)—Automatically rolled steel blade of tubular root zone and cavity airfoil zone precision rolled and pitch generated simultaneously.

two million pounds and its fluctuating horsepower in rolling is from 100 to 400 hp. The rolling time was 12 seconds for three passes per plate.

To undertake the order for 400 skelp plates, it was decided that all new equipment should be designed for assembly line production. Four months were required to design, build and put into operation a vertical, automatic progressive heating furnace (see Fig. 1), which has a speed of 80 billets per hour. It is very important to note the temperature control at the tip, where excessive rolling takes place, was 2100 F. At the point where rolling was slight, the temperature was held to 1450 F. The 10 inches of the unrolled skelp plate at the hub end were not exposed to heat. Excess reduction at high temperatures at the thin section improved the physical properties of the steel.

Referring to Fig. 1, the electric hoist has dropped one of the billets into the automatic loader, which stands in a vertical position for loading, and then swings the billet into the rolling position on the die. The billet is held in place by the gripping mechanism on the die.

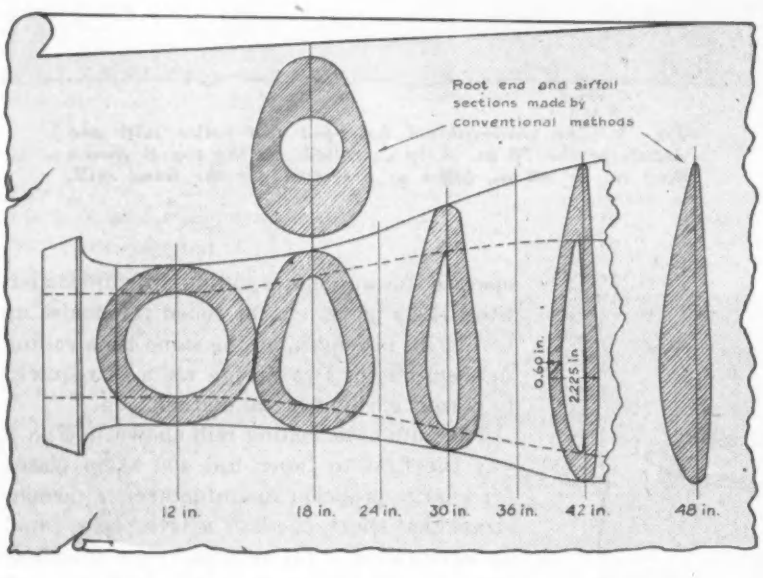


Fig. 6—Metal distribution in the aluminum alloy blade as prepared by automatic rolling compared with the present day hand-rolled and forged solid blade. The 18 in., 30 in. and 42 in. stations show the extent of the cavity in the precision rolled blade.

In Fig. 2 the top diagram is an outline of the billet 1 1/16 in. thick by 22 in. long for the multiple pass automatic mill. The lower diagram shows the billet in position at the start of rolling and the finished skelp, which is 1 1/16 in. thick at the hub zone and .050 in. thick at the tip with the entire airfoil zone automatically rolled to a tolerance of plus or minus .002 in., thereby eliminating machining at the airfoil zone, and also the upsetting operations and external ring welding operation at the hub zone. A skelp of this size with bridge wall requires only two passes and a rolling time of 8 seconds.

Fig. 3 shows finished skelp as rolled by the one-pass rolling mill of the manually-operated type. The skelp is too thin to make the blade hub end (dotted lines), thereby requiring an upsetting operation to increase the thickness of the metal

(*Turn to page* 170, *please*)

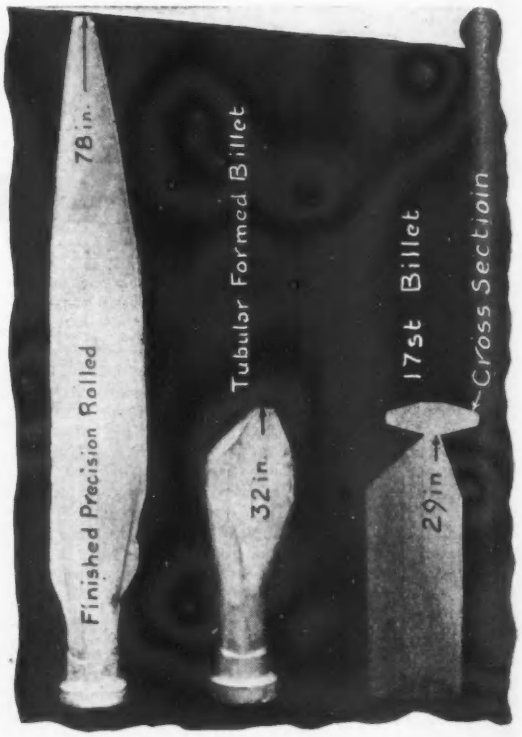
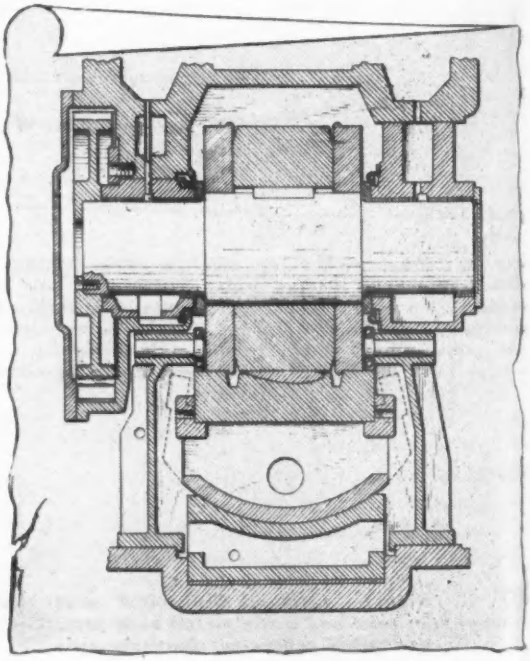


Fig. 7 (Above)— Two major stages in fabricating a tubular aluminum alloy blade. In the middle is the prepared tubular billet with a tubular wall thickness as shown in Fig. 6. It was made from the short billet (extreme right) sawed from the commercial rolled rod. At the left is the finished precision automatic rolled blade made from tubular billet.

Fig. 8 (Below)—The rocking die and gaging rollers of the mill in Fig. 1 for automatic precision rolling of propeller blades. This sectional view shows the setup for rolling the pitch and metal distribution in in the airfoil zone.



Mustang P-51B Fighter

THE latest version of the North American Mustang, the P-51B model equipped with a Packard-built Rolls-Royce Merlin engine and external fuel tanks on the wings, is the new long-range escort fighter that has been accompanying American bombers far into Germany on recent raids. Drawings showing the construction of the P-51A model were published in the Jan. 15 issue of AUTOMOTIVE AND AVIATION INDUSTRIES and to supplement that information on the design of the Mustang the following descriptive material is given on the P-51B model, which is reported to have a top speed of over 400 mph and a ceiling of 40,000 ft. The two-speed, two-stage supercharged Merlin engine, which is similar to the Merlin 61 engine on British Spitfires (see Jan. 15 issue of AUTOMOTIVE AND AVIATION INDUSTRIES), drives a four-bladed Hamilton Standard propeller of 11 ft 2 in. diameter.

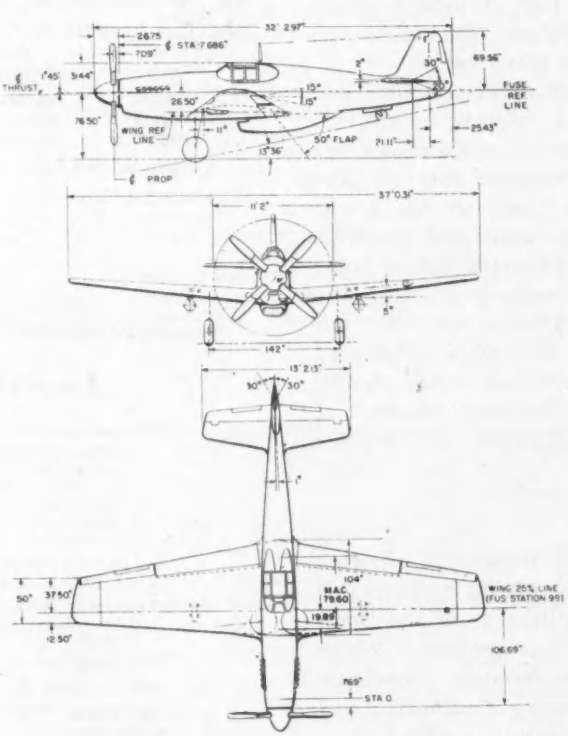
The airfoil section of the wings is an NAA modified NACA laminar flow, low drag type having its greatest thickness much farther back with the result that the new contour gives an effective distribution over 40 per cent of the chord as against 20 per cent in older designs. The wings, which have an area of 233.2 sq ft, consist of two panels bolted together at the center plane of the fuselage. Full cantilever, skin-stressed construction is used. The main and rear spars are of flanged aluminum alloy sheet construction. The flap and aileron hinge supports are mounted on the rear spar. The remaining structure consists of extruded stringers and pressed ribs. The skin covering is aluminum-coated aluminum alloy. The ailerons are of the sealed balance type.

The fuselage construction at the cockpit section consists of two curved side panels. Four longerons, two on each side of the cockpit, form the structure of the side panels together with the outer skin, which is reinforced by vertical frames. Aft of the cockpit, the longerons extend into a semi-monocoque structure reinforced by vertical frames. All skin and frames are aluminum-coated aluminum alloy. The fuselage is divided into three sections: the engine section, the main section, and the tail section. All sections are detachable, and attached with bolts. A combination engine coolant and aftercooler radiator is located at the bottom of the fuselage aft of the cockpit, and an oil temperature regulator is located forward of and beneath the engine coolant-aftercooler radiator in a separate duct. Both units are enclosed in a duct with automatically controlled, adjustable outlet air scoops.

The tail unit is a full-cantilever structure with a semi-monocoque fin and stabilizer, the latter being constructed as one unit with detachable tips. Its metal-covered structure consists of two spars, aluminum alloy ribs, and extruded stringers. The elevators, which consist of two sections, each interchangeable with the other, are of fabric-covered aluminum alloy construction, comprising a front spar, a short intercostal rear spar, flanged ribs, and metal leading and trailing edge sections. The fin structure comprises a forward and rear spar, flanged ribs, and extruded stringers. The rudder is similar in structure to the elevator and is fabric covered.

The alighting gear consists of two main landing gear assemblies and a steerable tail wheel. All three units are extended and retracted by hydraulic pressure. The tail wheel is capable of swiveling 360 deg and is steerable within the range of the rudder pedal travel. The wheels of the main landing gear units are fitted with hydraulic brakes.

The cockpit is under a flush type transparent canopy with an upper and right side section hinged to open for ingress and egress of the pilot. A sliding window is incorporated in both side sections. The enclosure, as a unit, may be quickly jettisoned for emergency egress of the pilot.



P-51 Mustang fighter, with Packard Rolls-Royce engine, being built by North American Aviation, Inc., for U. S. Army Air Forces and the British RAF.

Technical Developments Highlight Aeronautical I

by James R. Custer

LARGE attendances were recorded at the Twelfth Annual Meeting of the Institute of the Aeronautical Sciences when this regular event was held during the last week of January in New York City. It opened with the Honors Night Meeting, at which awards and honors were presented to men who have made outstanding contributions to the advancement of aeronautics. They are listed on the next page. On the following three days there were technical sessions that attracted close to 1000 prominent aviation people from industry, government and military circles.

Six new Council members were elected at the business session to fill expired and unexpired terms on that body. They are Robb C. Oertel, manager of the aviation sales department, Standard Oil Co. of New Jersey; Ralph S. Damon, vice-president and general manager of American Airlines; Paul R. Harrington, head of the aeronautical engineering department, Polytechnic Institute of Brooklyn; Alfred Marchev, president of Republic Aviation Corp.; Charles Froesch, chief engineer of Eastern Air Lines; and Earl D. Osborn, president of Edo Aircraft Corp. Officers elected by the Council for the current year are given below.

Over 50 papers were presented at 11 technical sessions covering a wide range of subjects in aircraft design and production, air transport, meteorology, instruments and materials. Exceptional interest prevailed at the rotary wing aircraft session, which was devoted to articulated rotor helicopters and problems of cyclic blade pitch control, unbalanced lifting rotor blades, and calculation of performance characteristics. Jet propulsion was discussed by some speakers, but their talks were limited to the general principles of the system due to military restrictions. Many significant data were given in the technical papers. A resume of a number of interesting papers will be given here.

New Aluminum Alloys

D. A. Lawless, of the Reynolds Metals Co., reported that aircraft manufacturers are giving considerable attention to R301, a new aluminum alloy of the modified Dural type in sheet form, the properties of which he discussed in his paper, "New Wrought Aluminum Alloys for Aircraft and New Temper Modifications of Present Alloys." It is supplied only in cladded form, the cladding responding to the same heat-treatment as the core. The highest strength of this alloy is developed by a heat-treatment, which includes artificial aging. On the basis of test results to date, Mr. Lawless quoted the following physical data for this alloy:

Alloy	Tensile Strength (psi)	Yield Strength (psi)	Elongation (% in 2 in.)
R301-O	30,000 (max.)	.....	16.0 (min.)
R301-W	57,000 (min.)	37,000 (min.)	16.0 (min.)
R301-T	65,000 (min.)	57,000 (min.)	8.0 (min.)

The quenching temperature for this alloy is 930-950 F; the aging treatment recommended is 18 hr at 320 F, if forming operations are involved after quenching. Five hours at 360 F is satisfactory if no forming is involved.

New alloys also are being developed in the intermediate zinc alloy classification, the nominal zinc content of which is between 5 and 8 per cent. Other alloying elements in relatively small percentages affect their characteristics considerably. Among these new alumninum-zinc alloys are XA75, 76S and R303. Characteristics of R303, the maximum physical and corrosion resistance properties of which are obtained by artificial aging, may be considered typical of this group, Mr. Lawless stated, and reported that the following physical properties will likely be developed:

Alloy	Tensile Strength (psi)	Yield Strength (psi)	Elongation (% in 2 in.)
R303-O	35,000 (max.)	.....	12.0 (min.)
R303-W	60,000 (min.)	40,000 (min.)	12.0 (min.)
R303-T	70,000 (min.)	65,000 (min.)	7.0 (min.)

As the above values are for forgings and for small extrusions, it is believed that the minimum strength

IAeS Officers for 1944

President—Major R. H. Fleet.

Vice Presidents—Wellwood E. Beall, vice president in charge of engineering, Boeing Aircraft Co.; William K. Ebel, vice president in charge of engineering and chief engineer, The Glenn L. Martin Co.; George M. Williams, vice president, Curtiss-Wright Corp.; Elmer A. Sperry, Jr., vice president, Sperry Products, Inc.

Executive Vice President—Bennett H. Horchler.

Treasurer—Charles H. Colvin, director, Daniel Guggenheim School of Aeronautics, New York University.

Chairman of the Council—Lester D. Gardner.

Assistant to the President—George R. Forman.

Secretary—Robert R. Dexter.

Controller—Joseph J. Maitan.

Institute Meeting

of larger extrusions will be increased to 75,000 psi tensile strength and 70,000 psi yield strength. The quenching temperature for R303 alloy is 810 F and it may be quenched either in hot water or light oil at room temperature, providing the material is going to be used in the "T" condition. No strain hardening is required before artificial aging to develop the optimum properties, but a room temperature aging period of 24 hr after quenching is recommended. The aging treatment is 320 F for 24 hr. The properties of the sheet form, XA75, are being investigated, but to date cladding it has not proven successful.

A free machining alloy can be produced by adding elements such as lead and bismuth into the standard 17S composition without any reduction of strength or corrosion resistance. This modified alloy also can be forged.

By stretching 24S sheet to approximately one per cent permanent set and then aging 16 hr at 350 F, or 10 hr at 375 F, its tensile and yield strengths are increased to about 68,000 and 62,000 psi respectively. However, Mr. Lawless believes future specifications will limit these respective strengths to about 65,000 and 57,000 psi to allow for commercial variations.

In his paper, "High Strength Casting Alloy with Natural Reaging Properties," Hiram Brown of the Frontier Bronze Corp. pointed out that a commercial aluminum casting alloy containing 5.25 per cent zinc naturally reages to a high strength equivalent to standard heat-treated alloys, thereby eliminating heat-treating problems. Since it reages naturally to regain high strength after exposure to temperatures as high as 1050 F suggests its use for parts which are to be brazed. Aging can be accelerated at 356 F. A 5.25 per cent zinc alloy containing magnesium but no copper has been found to have good corrosion resistance, a high endurance limit, and exceptional ability to withstand shock. Stress corrosion cracking is said not to occur in it.

Construction and operation of the new Iso-Rev

Institute of the Aeronautical Sciences Honors for 1943

JOHN JEFFRIES AWARD—to Brig. Gen. Eugen G. Reinartz, Army Air Forces, for outstanding contributions to the advancement of aeronautics through medical research.

SYLVANUS ALBERT REED AWARD—to Dr. Sanford A. Moss, General Electric Co., for development of the turbosupercharger which has made possible the high altitude operation of aircraft.

ROBERT M. LOSEY AWARD—to Lt. Col. Joseph J. George, chief, Special Studies Section, Weather Division Headquarters, Army Air Forces, for his contributions to the science of meteorolgy as applied to aeronatuics.

OCTAVE CHANUTE AWARD—to William H. McAvoy, chief test pilot, Ames Aeronautical Laboratory, Moffett Field, for continuous service in the flight testing of experimental airplanes under hazardous conditions imposed in aeronautical research.

LAWRENCE SPERRY AWARD—to William B. Bergen, chief flight test engineer, The Glenn L. Martin Co., for his theoretical and experimental studies of dynamic loads on airplanes.

THURMAN H. BANE AWARD—to Col. Hollingsworth F. Gregory, Army Air Forces, for his contribution to the military and commercial development and use of the helicopter.

HONORARY FELLOWSHIPS—General Henry H. Arnold, Commanding General, Army Air Forces; and Sir Richard Fairey, Director General, British Air Commission.

HONORARY MEMBERSHIP—Rear Admiral D. C. Ramsey, chief, Bureau of Aeronautics, Navy Dept.

FELLOWSHIPS—Wellwood E. Beall, vice president in charge of engineering Boeing Aircraft Co.; Capt. Luis de Florez, U. S. Navy, president of de Florez Engineering Co.; Ivan H. Driggs, principal engineer, Bureau of Aeronautics, Navy Dept.; Jack Frye, president, Transcontinental & Western Air, Inc.; Edward H. Heinemann, chief engineer of El Segundo Div., Douglas Aircraft Co.; Boris V. Korvin-Kroukovsky, chief engineer, Edo Aircraft Corp.; Eugene E. Lundquist, aeronautical engineer, National Advisory Committee for Aeronautics; James M. Shoemaker, chief engineer, Chance Vought Aircraft Div., United Aircraft Corp.; John Stack, research engineer; National Advisory Committee for Aeronautics; Jesse G. Vincent, vice president of engineering, Packard Motor Car Co.

constant speed propeller mechanism, mechanically actuated by energy of the rotating propeller shaft, were explained by Lloyd H. Leonard, chief engineer of the Zimmer-Thomson Corp. It is a self-contained unit and was developed by the company for military liaison and training planes, also being intended for light planes in general.

The automatic governor and pilot's selector control are located in the housing of the constant speed mechanism, which consists of two parallel V-belt pulley systems linking the propeller shaft with an adjacent governor shaft. One pulley system has a fixed drive ratio, the other system of split pulleys a variable ratio, which is regulated by the action of the centrifugal governor. A difference between the two ratios will cause the blade pitch to change. When any deviation from the desired speed setting occurs, the governor changes the ratio of the variable drive and in turn the pitch is set to return the propeller and engine to the selected speed. The pitch-changing operation is said to be inherently self-dampening.

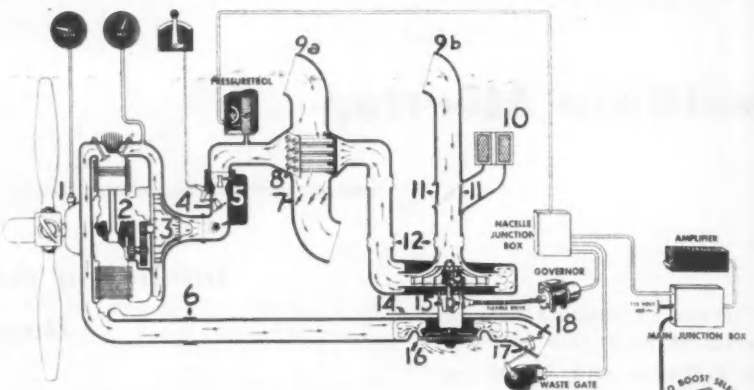


Fig. 1—Schematic diagram of Type B Electronic Turboregulator system as applied to a single-engined installation. When installed on a multi-engined aircraft, such as a B-17 bomber, one turbo-boost selector controls the four electronic systems of the turbo-supercharged engines.

1. Propeller Governor
2. Gear Drive for internal blower
3. Internal blower
4. Throttle
5. Carburetor
6. Expansion joint
7. Intercooler shutters
8. Intercooler
9a. Intercooler air scoop
9b. Carburetor air scoop
10. Air filter
11. Filter control gates
12. Flexible couplings
13. Turbo compressor
14. Heat baffle
15. Worm gear drive
16. Turbine wheel
17. Waste gate stop
18. Waste gate

Electronic System for Turbosupercharger Control

The Type B electronic turboregulator system, with which many of America's heavy bombers are equipped for automatically and simultaneously controlling their four turbosupercharged engines, was described in a paper prepared by W. H. Gille, chief engineer, and H. T. Sparrow, chief electrical engineer, of the Aeronautical Division, Minneapolis-Honeywell Regulator Co. All engines of a multi-engined aircraft are controlled to a fixed carburetor inlet pressure that is manually preselected for the particular operation, thus making this electronic control system practically independent of ambient pressures. Being electrical, extreme operating temperatures have almost no effect upon it.

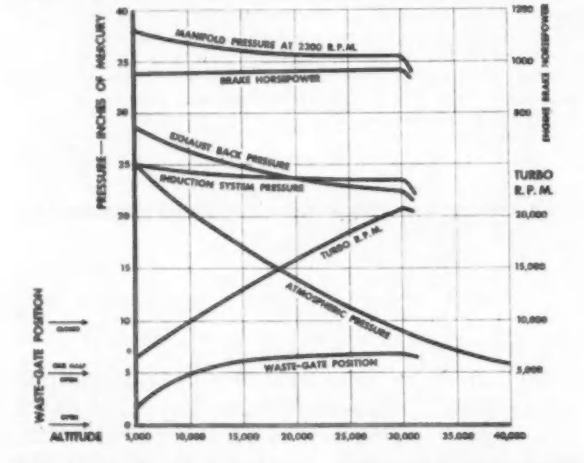


Fig. 2—Typical operation curves of an electronic-controlled turbosupercharged engine during a climb with the manifold pressure maintained at 37 in. Hg.

The single-engined installation, a schematic diagram of which is shown in Fig. 1, consists essentially of a waste gate motor, an induction system Pressuretrol, a turbo amplifier, a turbo governor, a turbo-boost selector, a nacelle junction box, and a main junction box. In a multi-engined airplane, the installation includes one turbo-boost selector, which is located in the cockpit, and one main junction box, plus one each of the other five units for each engine. The complete system is operated on the 115-volt 400-cycle alternating current supplied by the airplane's inverters. Power required is 67 volt-amperes per engine.

The waste-gate motor, a two-phase reversible unit which positions the waste-gate through a mechanical linkage and also operates a balancing potentiometer that serves to neutralize signals from the rest of the system, is controlled automatically by electrical signals from the turbo-boost selector, the Pressuretrol,

(*Turn to page 82, please*)

Airbriefs

By Henry Lowe Brownback

Drawings

Drawings and material lists have been the plague of the intensified airplane program and most of the delays which one hears about are basically "drawing delays" because of the designing of something, by inexperienced help, which cannot be built in the shop, drawing errors or poor material lists. This has been true particularly in the shops of the sub-contractor or of the contractor working to drawings made in another shop. The shop of origin has usually been an old-time airplane plant in which the mechanics could take rather sketchy drawings and turn out a first-class airplane, the plan then being to correct the drawings to the ship, but often the uncorrected drawings get out and no end of confusion results.

The really bright spot of the drawing program has been the various photographic processes developed to eliminate templates and the use of perspective projections as guides for workmen who might have difficulty in figuring out complicated parts from ordinary drawings or to illustrate complicated assemblies. Too much detail is lost when retouched photographs are used for this purpose.

The readers of AUTOMOTIVE AND AVIATION INDUSTRIES have had some very fine examples of such drawings published for them illustrating many of the better-known fighter planes and it is becoming evident in the shops that perspective drawings properly dimensioned are going to replace the old dimensional line drawings in many places.

German Troop "Gliders"

On a recent visit to the British Embassy I was shown pictures of the large German troop-carrying powered gliders. Why these ships were ever called gliders is beyond me unless the original plan was to tow them. As finally built, they are six-engined troop transport planes fitted with 750 hp Gnome et Rhone engines which are just about like the Wright Cyclone. They are about half again as big in every dimension as the largest British four-motored bombers and do some 175 mph or approximately the speed of the Mars. The construction is glider-like —steel tubes, plywood and cloth-covered fuselage with the whole nose opening up to take on or discharge men or matériel. The wings and other surfaces are lumber, plywood and cloth.

Tin Lace

The modern airplane is a complicated mechanism with much piping, complex instruments, many little electric motors and hydraulic gadgets, all of which combine to make a marvelous though costly whole. The postwar sport plane will contain simplifications of many of these things and it is to be hoped that the aircraft manufacturer will not fall into the error of the motor car builder of the late thirties and force the engineer to try and put his machinery into something designed by a commercial artist who knows only eye appeal and surrounds the machinery with tin lace which must be removed in order to do anything at all. The radial engine started out as a model of simplicity and accessibility, but by the time it got up into the high bmep class had to be completely cowled for proper cooling and then had several varieties of pumps and other accessories added to the rear cover, it sometimes became a nightmare. Fortunately the plane manufacturer has seen the light and has added auxiliary engines to do many of the things formerly put on the main engine and simplification is in order. I may be wrong, but to my mind the master engineer is he who can do many things with simple machines as anybody can continually add complications to an existing machine just as long as there is room for them and the sad part of the whole history of machinery is that the principle or basic machine seldom "acts up," but the auxiliaries give all sorts of trouble or require more or less constant servicing. Just as the hydraulic brake substituted a pump, some tubes and four simple cylinders for a maze of rods, cables, clevis pins, equalizers and other parts which wore, rattled and required adjustment, other equally simple machines will be substituted for many of the complicated ones we use today.

Navigation

For scores of years navigation went on its old routine without much change or progress. During the last war some small sextants were brought out, but the first two great changes were the new earth inductor compass used by Lindbergh on his Paris flight and the new H.O. tables with the pre-calculated sights needing only a small part of the work used formerly in the calculating of a position. The present war with the necessity of training hundreds of navigators capable of guiding planes making not "knots," but hundreds of miles per hour, forced the perfection of all sorts of devices. First the bubble compass with artificial horizon and last a navigational machine which does the whole job excepting sighting the altitude of the heavenly body used. All of this will be of tremendous aid to navigators on the sea as well as in the air when the war is over. Instrument flying has also been revolutionized, and while we still have plenty of accidents due to bad visibility, we have made very definite progress.

Fastenings

Another place where the war has speeded up progress is in blind riveting, using one of the several mechanically spread rivets or the explosive rivet. The field of shake-proof and vibration proof fastenings has also been well rounded out. Before the war anything made of sheet metal unless welded tended to come loose and get "tinny," but now with the new types of fasteners available we will be able to make things tight and to keep them so. Elimination in many places of the old friend, the split cotter pin, will be welcomed by mechanics in general and by amateur mechanics in particular. The old cotter will certainly not disappear, but its use in many "hard to get at" places will end and the multiple lock nuts and the wing-type permanently fastened to sheet metal parts will save much cussing and many scratched fingers.

Brazing Aluminum

I have had so many letters asking about the furnace brazing of aluminum and requests for the address of the persons doing it that I am going to break my rule of not mentioning names. Most of the work about which I have been informed has been done in the manufacture of aluminum cooling radiators and both Harrison at Lockport and Clifford at Boston are doing brazing jobs. Just what the patent situation is and just how much they are willing to tell I do not know.

Enemy

By Major General G. M. Barnes
Chief, Technical Division,
Ordnance Dept., U. S. Army

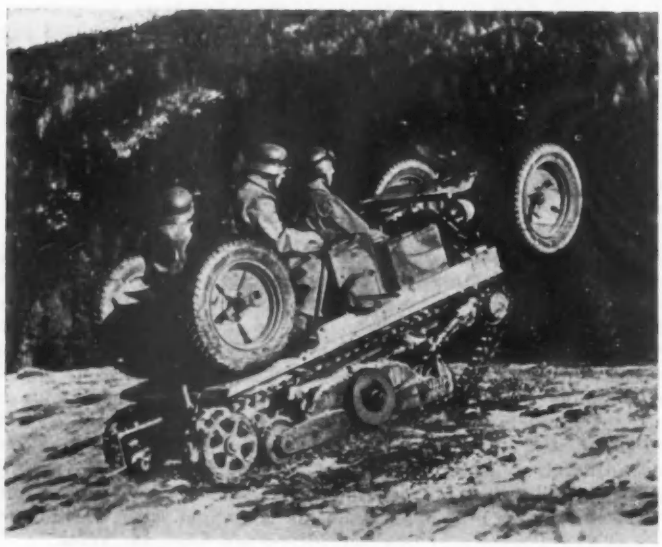
(Right) German ¾ track vehicle of heavy duty type (British Combine photo).

(Left) A type of Japanese tractor for towing artillery and transporting the crew (Acme photo).

A Japanese tractor captured by the Marines on Kolombangara Island (Wide World photo).

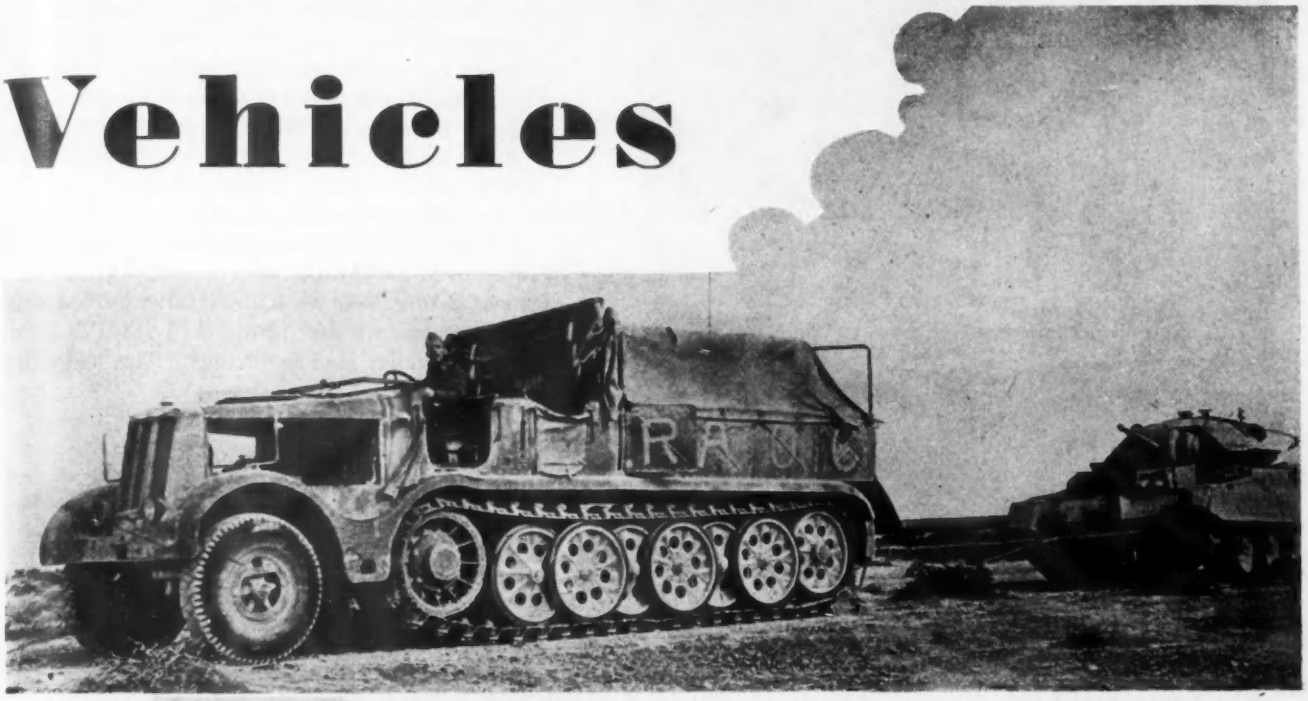
JAPAN did not produce any tanks of her own until 1929. Her first tanks were Oriental copies of the early French Renault, British Vickers and Carden-Lloyd tanks. More recently the influence of German design can be seen. The Japanese apparently assign tanks to operations according to terrain. It is, therefore, unlikely that their heavier tanks will be seen outside of China. Although the Japanese have used some 57 mm and 75 mm guns in their tanks, their standard tank gun appears to be the 37 mm. We do not have all models of Japanese tanks at Aberdeen Proving Grounds yet, but we are continually increasing the number of types. We found a light tank, Model 2595, in operating condition on the top of a mountain at Attu and this tank is now at Aberdeen. This Japanese light tank weighs approximately 8 tons with plates from ½ in. to ¾ in. in thickness. The tank is powered with the 6-cylinder in-line Diesel air-cooled engine of sufficient power to give the tank excellent mo-

This article is an abstract of the address which General Barnes delivered Jan. 12 at the War Engineering-Annual Meeting of the Society of Automotive Engineers in Detroit.



The Germans used mechanized units of this design in the Baldwin mountains. The wheels can be installed for operation on roads (Acme photo).

Vehicles



Half track motorcycle used by the Germans for hauling ammunition and light towing (British Combine photo).

bility and a maximum speed of approximately 25 mph. Steering is accomplished by a clutch brake system.

One of the most recent vehicles to arrive at the Aberdeen Research Center is the Japanese 2½-ton truck. The 6-cylinder gasoline engine is the L-head type with tappet covers on one side. A separate external drive with flexible couplings power the generator, distributor, oil pump and in some cases the water pump. Ignition as usual is by Bosch. All of the tandem rear wheels are worm driven, with differential housings stabilized from a tubular cross member in the frame. This is a purely German design. The wood body is provided with steel reinforcing ribs. While at the rear short semi-elliptical springs are used to cushion the shock on the pintle.

The Japanese Tractor is a light weight prime mover designed for towing light artillery and transporting the gun crew of six. It is powered by a 6-cylinder in-line gasoline engine with power take-off for the worm driven winch mounted in the rear. Eight pairs of steel flanged bogie wheels provide undulation for the suspension. The tracks are 10 in. wide. Ground contact is about 7 ft. This vehicle has a speed of 10 mph.

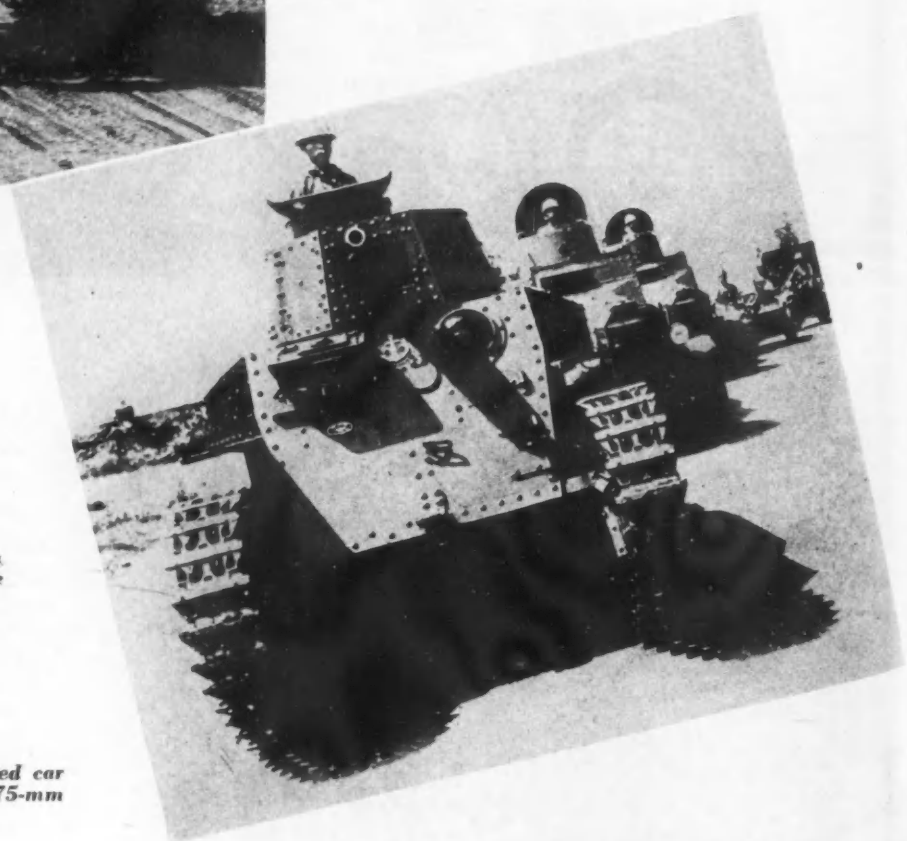
German Materiel

In this war, the Germans are the leaders in the half-track field. They have produced a wide range of vehicles, from a 1-ton for use with infantry, to the large 18-ton vehicle for hauling the heavy types of German Army artillery. There are 6 types of these vehicles: 1-ton, 3-ton, 5-ton, 8-ton, 12-ton and 18-ton. Perhaps, more accurately, these vehicles should be called ¾ tracks, because the track has been lengthened by bringing the front drive sprocket up as close as possible to the front wheel. This has the advantage of making it nearly impossible to hang up the vehicle by ground interference with the

body between the front wheel and the track.

The 1-ton half-track vehicle is used to carry infantry troops and also for drawing light infantry howitzers and light anti-tank guns. The 3-ton half-track vehicle carries a 1½-ton payload in the body and is likewise designed to haul a trailer load of 3 tons. The 5-ton German half-track vehicle carries a payload of 1½ tons and is capable of hauling an additional trailer load of 5 tons. The 8-ton vehicle is the most universally used half-track. It can carry a payload of about 2 tons with an added trailer load of 8 tons. The payload of the 12-ton half-track is 3 tons and the trailer load is 12 tons. The 18-ton German half-track vehicle carries a 4-ton payload and can pull a trailer load of 18 tons.

(Above) This German vehicle was captured during the drive along Italy's Adriatic Coast. The cab with submerged lights and full tracks indicate that it is new equipment (British Combine photo.).



(Right) Japanese light tank on parade in Guam (British Combine photo).

(Below) German 8-wheeled armored car (tank destroyer) equipped with 75-mm cannon (Acme photo).

German half-tracks are steered by the combined action of turning the front wheels and braking the rear track on the inside of the turn. The steering brake drums are carried on the final drive shafts between the gear box and the driving sprockets and can be seen to the right of the picture. Operation of the brakes comes into play at 18 deg. turn or approximately 2/3 full cut of the front wheels. In the full-cut position of the front wheels, it was found by experiment that the braked sprocket completed 15 revolutions to every 20 revolutions of the unbraked sprocket. The controlled differential

allows all of the power to be applied to the sprockets.

The tracks on the German half-track vehicle is the best type of track produced by the Germans. It has a cast steel frame to which replaceable rubber pads are bolted. The track pins turn on needle roller bearings which are protected by special rubber seals. This needle bearing track gives splendid performance with a rolling resistance of 43 lbs. per ton of vehicle weight.

A 320-hp V-8 engine powers this German Mark IV tank (Acme photo).

German Mark VI Tiger tank "out" in Italy (British Combine photo).

The German 8-wheeled drive reconnaissance car in its most usual form has approximately ¼ in. side armor. All 8 wheels are independently driven and independently sprung, and all wheels steer. The mobility of this vehicle, while good in sand, is disappointing in mud. The Germans apparently have not found their 8-wheeler up to expectations, since it has been encountered in decreasing numbers in the more recent campaigns.

German motorcycles are very well engineered in all respects. The conventional military type of motorcycle with side car, drives on both of the rear wheels. Its attractive engine is manufactured by Bayrische Motorenwerks. The German half-track motorcycle (detailed description in Sept. 15, 1943, isue of AUTOMOTIVE AND AVIATION INDUSTRIES) weighs approximately 2700 lbs. and has a combat crew of 2 men. Its maximum weight is 3400 lbs, being designed for a payload of 700 lbs.

The larger of these vehicles have a dual fuel system. A small tank located under the dashboard contains high volatility fuel for starting the Maybach gasoline engine. Immediately after starting, the engine is operated on the fuel from the main tank. Maybach engines of the 6-cylinder in-line or 12-cylinder V-type are used for all half-track vehicles. Bogie wheels, of the suspension systems, are mounted in pairs on a forked axle which is attached at the end of a beam pivoted at the other end. A leaf spring supports the load. At the rear there is a trailing idler with a torsion bar suspension and means for adjusting the tension of the track.

These are military vehicles engineered over many years in which the key attribute is interchangeability. A minimum number of components have been used in the construction of all 6 vehicles of this class. Thus, the engines are all the same type—Maybach 6- and 12-cylinder, but of suitable size for the vehicles in each series. Likewise, the tracks are basically alike. This also applies to many other features in which a component part is made to interchange and no opportunity is lost in their designs to reduce the number of spare parts.

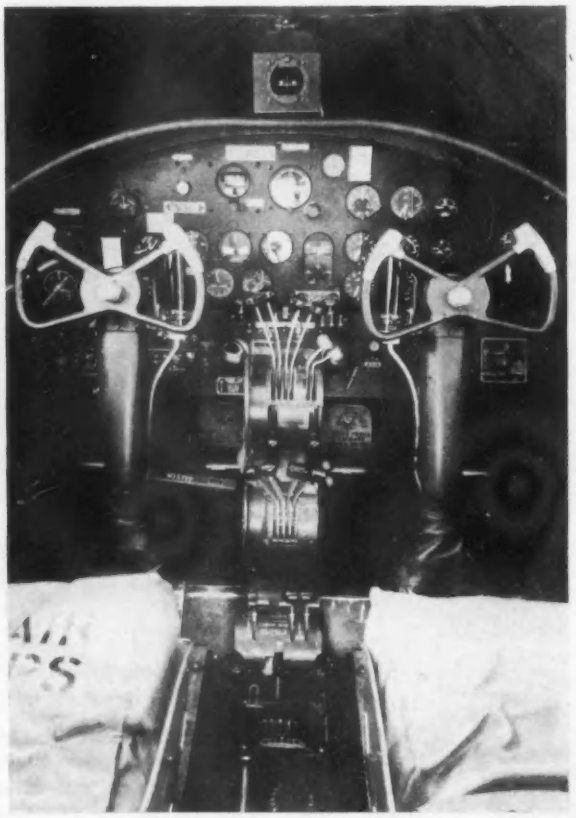
The Panzer Kw III and IV were the principal tanks on the German battlefields of 1942 and 1943. Both weigh approximately the same, about 25 tons. It is interesting to note that the Germans have continued these models in use, but at the same time have constantly improved them, year by year. Starting in 1936 with both models, there have been 19 principal modifications to the Kw III and 7 modifications to the Kw IV. In the case of the Kw III, the tank started off with a suspension using coiled springs. Then a change was made to semi-elliptic leaf springs and later in place of two springs, three springs were introduced, and so on various changes of suspension until in the fifth model the torsion bar suspension was adopted.

There was a corresponding evolution in the armament of the Kw III. At first the 37 mm tank gun was used. In 1939 the armament was changed to a 50 mm

(*Turn to page 80, please*)

North American's

B-25C



Pilot's Compartment

Cabin of pilot and co-pilot showing control columns and wheels, instruments and dials.

ENGINE MOUNTING — The chrome moly tubular mount of each engine is attached to the firewalls at four points with special 5/8 in. bolts. The power plant assembly as installed at the firewall weighs 2520 pounds, plus a 455-pound propeller. Lord suspension mountings absorb torsional vibration. Either the entire assembly or the engine alone can be removed with a hoisting sling. Combination electric inertia and direct cranking starters are provided. There are flame suppressor exhaust stacks to reduce the betraying glare during night flying; cowl flaps and oil cooler shutters to give control of engine temperatures, and electric primers for cold weather use.

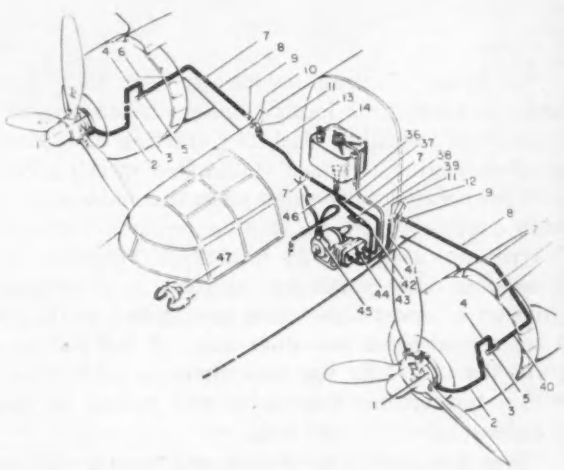
Oil and Fuel Systems

Each engine has an independent oil and fuel system, with electric, motor-driven fuel booster and transfer pumps to insure a positive gasoline flow. Two main fuel tanks and three auxiliary tanks in each wing, all supplemented by a 585-gallon droppable tank, to give a total supply of 1559 gallons. Self-sealing oil cells, 37.5 gallons for each engine, are located in each nacelle. There are two automatic temperature regulators and indicators, and engine-driven oil pump, and oil dilution system.

Hydraulic System

A single hydraulic system, using an operating pressure of 1000 psi, is employed for concurrent operation of the main landing gear and nose gear and for the selective operation of wing flaps, engine cowl flaps and bomb bay doors. The system incorporates a pressure storage of 1150 pounds for operation of the brakes. Two engine-driven pumps, one on each engine, furnish the pressure and are capable of individual operation of the system. For ground and emergency use, a hand pump can be used effectively, even though the supply for the engine pumps is lost. The pressure accumulators are in the navigator's cabin, one for the general supply and the other for the brakes.

Power for the Sperry automatic pilot, when installed, is derived from the right engine pump. The landing gear responds completely within 25 seconds, the wing flaps within 20 seconds, engine cowl flaps within 6 seconds and the bomb doors within 3 seconds. Special hydraulic fluid, resistant to a tempera-



Propeller Anti-Icing System

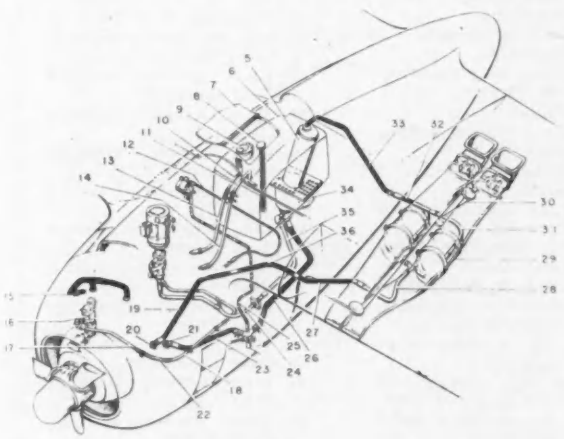
1. Slinger ring
2. Tube assembly
3. Hose
4. Tube assembly
5. Check valve
6. Tube assembly
7. Union
8. Line assembly
9. Nipple
10. Block—Disconnect
11. Elbow
12. Block—Disconnect
13. Line
14. Tank assembly
36. Line
37. Line
38. Valve—Two Way Plug
39. Line
40. Tube assembly
41. Line
42. Line
43. Drain assembly
44. Filter-Anti-Icer Fluid
45. Pump
46. Line
47. Rheostat

By N. S. Houston
Assistant Chief Engineer,
North American Aviation, Inc.

and D Bomber

Part Two

Part I appeared in the Feb. 1 issue of AUTOMOTIVE AND AVIATION INDUSTRIES



Oil System

1. Solenoid—Oil Dilution
2. Pump—Feathering
3. Fitting
4. Valve—"Y" Drain
5. Hopper
6. Cell—Self Sealing Oil
7. Door — Oil Tank Filler Access
8. Rod — Oil Level Indicator
9. Cap—Oil Filler
10. Line—Oil Vent Rear
11. Line — Oil Vent Rear Outboard
12. Line—Solenoid to Restrictor Valve
13. Line—Oil Vent Forward Inboard
14. Line—Oil Vent Forward Outboard
15. Tube—Breather
16. Governor—Propeller
17-18. Line—Propeller Feathering
19. Line—Oil Return
20. Fitting—Oil Return Line to Engine
21. Fiting—Oil in Line to Engine
22. Hose—Flexible
23. Line—Oil In
24. Line Propeller Feathering
25. Line—Solenoid to "Y" Valve
26. Line—"Y" Valve to Sump
27-28. Line—Oil Return
29. Oil Cooler
30. Oil Cooler Shutter Controls
31. Line—Outboard Cooler to "Y"
32. Line—Cooler Outlet "Y"
33. Line — Cooler "Y" to Tank
34. Bottom Assem.—Oil Tank
35. Line—Propeller feathering Rear
36. Line—Oil Return

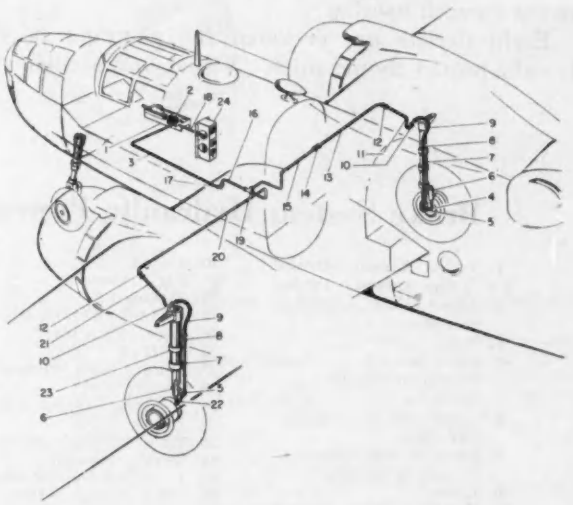
ture of minus 40 F, fills the 5.9 gallon hydraulic reservoir in the navigator's cabin.

Electrical System

A direct current, single-wire electrical system for operation of the radio, lights, electric motors, starters and for certain instruments, is provided by a 24-volt battery inside each engine nacelle, charged by 200-ampere, 30-volt generators on each engine. Either battery will operate the electrical system, including the starters.

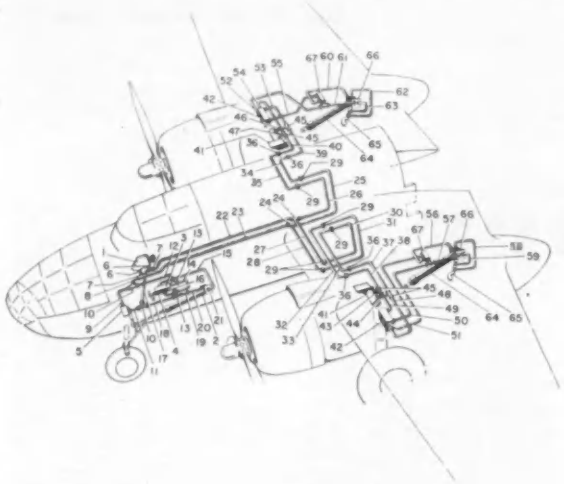
Battery-driven rotary inverters, located in the bomb bay passageway, supply the alternating current required by some units. The inverters are of 750-volt-ampere capacity and change the direct current to 400 cycle alternating current, which is used for the fluorescent lights, radio compass Autosyn instruments and compass illumination. There are remote-indicating engine instrument transmitters in each nacelle, connected to indicators for fuel, oil and manifold pressure, oil temperature and tach-meter. Electrical indicators are provided for fuel level, landing gear and wing flap position.

Exterior lighting consists of two landing lights, a passing light and six position lights. Red, green, and amber recognition lights beneath the right wing tip, and a clear lamp above, are installed to flash signals or burn steadily. Cockpit, dome and extension lights are provided for the various stations. Fluorescent lights for the pilot's instrument panel are powered



B-25 Pneumatic Brake System

1. Pilot's lower pedestal
2. Brake control valve
3. Pneumatic brake lines
4. Pneumatic brake
6. Transfer valve
9. Flexible hose
11 to 22. Lines
23. Main landing gear chassis
24. Pneumatic brake tank and guage assembly



Landing Gear Hydraulic System

1. Valve Assem.—Selector
2. Strut Assem.—Hydraulic Nose Wheel Operating
3. Valve Assem.—Nose Gear Timing
4. Lock Assem.—Nose Gear Extended
5. Lock Assem.—Nose Gear Retracted
6. Line Assem.—Selector Valve
7. Tee
8-9. Line Assem.—Nose Gear Down
10. Tee
11. Line Assem.—Nose Gear Up
12. Line Assem.—Nose Gear Down
13. Tee
14. Line Assem.—Timing Valve to Lock
15. Line Assem.—Timing Valve to Strut
16. Line Assem.—Up Lock to Tee
17. Line Assem.—Nose Gear Up
18. Line Assem.—Nose Gear Up
19. Restrictor
20. Line Assem.—Restrictor to Strut
21. Bearing Assem.—Nose Strut
22. Line Assem.—Main Gear Up
23. Line Assem.—Main Gear Down
24. Tee
25. Line Assem.—Main Gear Down
26-27. Line Assem. — Main Gear Up
28. Line Assem.—Main Gear Down
29. Union
30. Line Assem.—Main Gear Up
31-32. Line Assem. — Main Gear Down
33. Line Assem.—Main Gear Up
34. Line Assem.—Main Gear Down
35. Line Assem.—Main Gear Up
36. Union
37. Line Assem.—Main Gear Up
38-39. Line Assem. — Main Gear Down
40. Line Assem.—Main Gear Up
41. Lock Assem.—Main Gear Extended
42. Valve Assem.—Main Gear Hydraulic Timing
43. Line Assem.—Extended Lock to Tee Down
44. Line Assem.—Extended Lock to Tee Up
45. Tee
46. Line Assem.—Extended Lock to Tee Down
47. Line Assem.—Extended Lock to Tee Up
48. Line Assem. — Landing Gear Up
49. Line Assem. — Landing Gear Down
50. Line Assem. — Landing Gear Up
51, 52, 53. Line Assem.—Landing Gear Down
54, 55, 56. Line Assem.—Landing Gear Up
57. Line Assem.—Landing Gear Down
58. Line Assem.—Landing Gear Up
59. Line Assem. — Landing Gear Down
60. Line Assem. — Landing Gear Up
61. Line Assem. — Landing Gear Down
62. Line Assem. — Landing Gear Up
63. Line Assem. — Landing Gear Down
64. Strut Assem.—Main Gear Operating
65. Lock Assem.—Main Gear Up
66. Block Assem.—Main Gear Strut
67. Valve Assem.—Hydraulic Cross Flow

by 115 volts ac from the inverter. Conventional lights are also provided. Fluorescent markings on charts, controls and panels make them visible under ultra-violet light, when the cabins are blacked out in night operations.

The portion of the electrical system controlling power plant operations consists of engine starters, primers, the ignition system, propeller feathering pumps, and oil dilution solenoids. The feathering consists of push button solenoid switches on the pedestal switch panel, and a feathering pump motor in each nacelle.

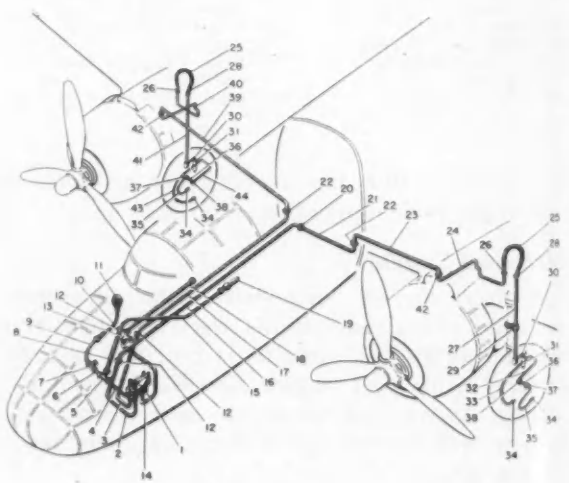
Eight outlets are provided for plugging in electrically-heated flying suits. Visual and audible electrical warning systems are connected with the landing gear, lower turret and trailing antenna systems, to warn of unsafe landing conditions.

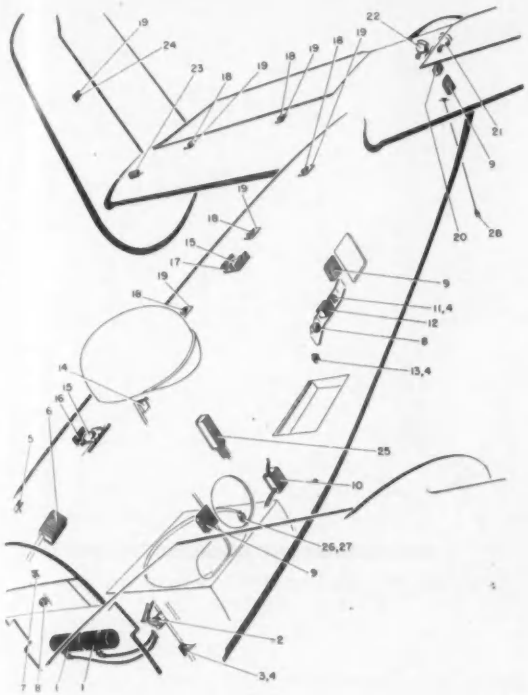
Upper and lower Bendix power-driven gun turrets are operated from the airplane's electrical system. A blue lamp on the pilot's switch panel warns if the nose gear is down and when the lower turret is extended. Other electrically-operated units are the pilot static

(*Turn to page 74, please*)

Brake System Hydraulic Power

1. Valve Assem.—Brake
2-3. Line Assem.—Brake
4. Line Assem.—Brake Pressure
5. Tee
6. Line Assem. — Brake Pressure Gauge
7. Snubber
8. Line Assem.—Brake Pressure
9. Line Assem.—Brake Pressure Gauge
10. Hose
11. Gauge—Brake Pressure
12. Union
13. Tee
14. Line Assem.—Brake Pressure Return
15. Line Assem.—Brake Pressure
16-17. Line Assem.—Brake
18. Line Assem.—Brake Return
19. Filter
20. Union
21. Line Assem.
22. Fitting
23-24. Line Assem.—Brake
25. Line—Flexible
26. Fitting
27. Line Assem.—Brake
28. Nipple
29. Bearing Assem.—Brake Lines
30. Line Assem.—Brake
31. Valve—Shuttle
32. Line Assem.—Brake
33. Line Assem.—Brake
34. Swivel
35. Line Assem.—Brake
36. Line Assem.—Brake
37. Coupling
38. Elbow
39. Line Assem.—Brake
40. Line Assem.—Brake
41. Line Assem.—Brake
42. Union
43. Line Assem.—Brake
44. Line Assem.—Brake



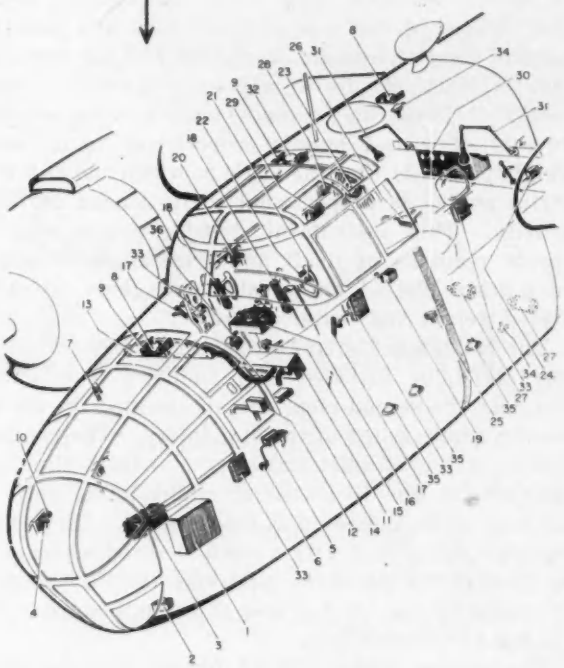


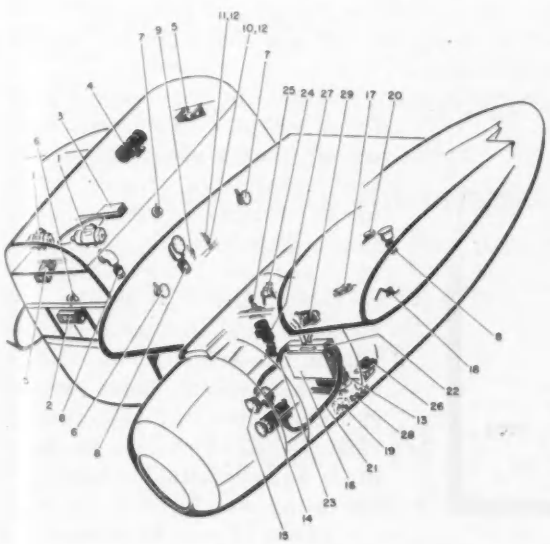
Rear Section Electrical Equipment

1. Motor—Amplidyne
2. Transmitter—Flap Position
3. Box Assem.—Bomb Bay Dome Light
4. Switch
5. Box Assem.—Dome Light Switch
6. Box Assem.—Junction
7. Switch
8. Bell
9. Rheostat
10. Box Assem.—Turret Power Junction
11. Box Assem.—Dome Light Switch
12. Box Assem. — Camera Power Junction
13. Box Assem.—Dome Light Switch
14. Lamp Assem. — Turret Extension
15. Lamp Assem.
16-17. Bracket
18. Lamp Assem.
19. Cover—Formation
20. Box Assem.—Junction
21-22. Lamp Assem.
23. Box Assem.—Tail Light Junction
24. Lamp Assem.
25. Box—Upper Turret Master
26. Box Assem.—Lower Turret Warning Switch
27. Micro-Switch
28. Dissipator

Front Section Electrical Equipment

1. Box Assem. — Bombardier's Control Panel
2. Box Assem.—Bomb Release Switch
3. Interval Control
4. Lamp Assem. — Extension
5. Switch Assem.—Landing Gear Warning Signal
6. Transmitter—Position
7-8. Lamp
9. Bracket
10. Lamp Assem.
11. Box Assem.—Pilot's Switch
12. Box Assem. — Bombardier's Junction
13. Box Assem.—Pilot's Instrument Panel Distribution
14. Box—Auxiliary
15. Switch — Landing Gear Signal
16. Box Assem. — Pedestal Switch
17. Lamp—Cockpit
18. Lamp
19-20. Box Assem. — Cockpit Light
21. Switch—Gun
22. Switch—Torpedo
23. —Signal—Landing Gear Warning
24. Box Assem.—Heater Control Switch
25. Box Assem.—Bomb Door Open Switch
26. Box Assem. — Ignition Junction
27. Inverter Assem.
28. Lamp Assem.—Extension
29. Box Assem. — Navigator's Switch
30. Box Assem. — Navigator's Fuse
31-32. Lamp Assem.
33. Rheostat—Heated Clothing
34. Lamp Assem. — Recognition
35. Lamp Assem.
36. Lamp Assem. — Pilot's Extension

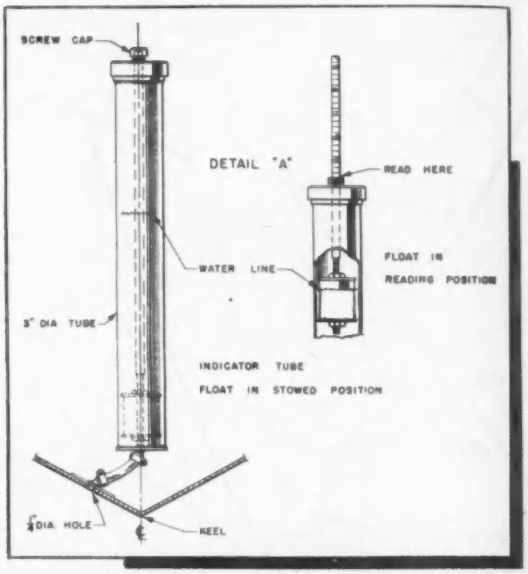




Center Section Electrical Equipment

1. Inverter Assem.
2. Box Assem.—Bomb Bay Junction
3. Box Assem.—Bomb Rack Junction
4. Motor—Amplidyne
5. Lamp Assem.
6-7. Gauge
8. Pump—Fuel Booster
9. Plug—Droppable tank jack
10. Micro-Switch—Torpedo Release Transfer
11. Micro-Switch—Torpedo Release
12. Insulator
13. Battery
14. Generator
15. Starter
16. Box Assem.—Nacelle Power Panel L. H.
17. Switch—Landing Gear Warning Signal L. H.
18. Transmitter—Position
19. Box—External Battery Connector (R. H. Nacelle only)
20. Gauge
21. Conduit
22. Plug Assem.—Generator Disconnect
23. Conduit
24. Valve—Oil Dilution Solenoid
25. Valve—Heater Solenoid
26. Panel—Autosyn Instrument
27. Pump—Propeller Feathering
28. Bulb—Oil Temperature Resistance
29. Transmitter—Tachometer

Flying Boat Loading Instrument Developed by Martin Engineers



Details of the Hydrobal instrument on a PBM-3C Mariner

THE Hydrobal, an automatic weight and balance indicator for simplifying loading operations and reducing the loading costs of flying boats, has been developed by The Glenn L. Martin Co. and is now in use on the Mars and other Martin flying boats. A sort of super-accurate Plimsoll's mark (the load line painted on the side of all British and American surface vessels) brought inside the hull for easy reading, the Martin Hydrobal makes use of two well-known facts: (1) that the distance from keel to waterline (draft) of a boat hull is proportional to its loaded weight; and (2) that the angle at which the hull floats (trim angle) is proportional to its loaded center of gravity. This instrument provides rapid and accurate readings of draft and trim angle which can be quickly plotted on a calibrated chart to obtain loaded weight and center of gravity.

The instrument itself consists of a three-inch diameter standpipe installed near the bow, and another one near the second step. Small openings in the hull bottom admit water to the standpipes. The combination of restricted inlet and large standpipe eliminates inaccuracies due to waves or slight pitching of the airplane while a reading is being taken. Each standpipe contains a float with a graduated rod which sticks up through the top of the pipe, and waterline readings are taken of the intersection of these float rods with the top of the standpipe.

The average of the forward and aft readings is proportional to the weight. The difference of the two readings is proportional to the trim angle, and hence to the center of gravity. To find the loaded weight and the center of gravity, it is only necessary to plot the readings on a previously calibrated chart. Separate charts may be used for fresh water and sea water, or the same chart may be used with a collar on the standpipe that changes the reading level to correspond with variations in water density.

The Hydrobal requires no complicated adjustments or servicing, and may be prepared in kit form for service installation. Accuracy is dependent only on the original calibration and on the manufacture of all floats to an identical buoyancy. Tests on the Martin Mars and PBM-3 Mariner flying boats have been made under practical operating conditions, with accurate readings being taken in as much as 25-mph wind and two-foot waves. None of the check readings have varied more than 0.8 of 1 per cent of the gross weight and ½ per cent center of gravity of the mean aerodynamic chord from the corresponding calculated readings. This is said to be better than the average accuracy obtained with far more laborious methods of flight calculations. With this instrument it now becomes possible to load a flying boat, take a rapid reading, and then, if the weight or center of gravity are not within the desired limits, to remove or shift some of the load and make another reading before take-off.

While the present Hydrobal is considered a great improvement over current methods of loading calculations, further refinements of this instrument which give a direct indication of weight and center of gravity on dials without recourse to charts or graphs have already been developed in the Martin Laboratories. In one version the present floats actuate electrical circuits, the variable currents in which can be measured on electrical meters, one indicating weight, and the other

(*Turn to page* 88, *please*)

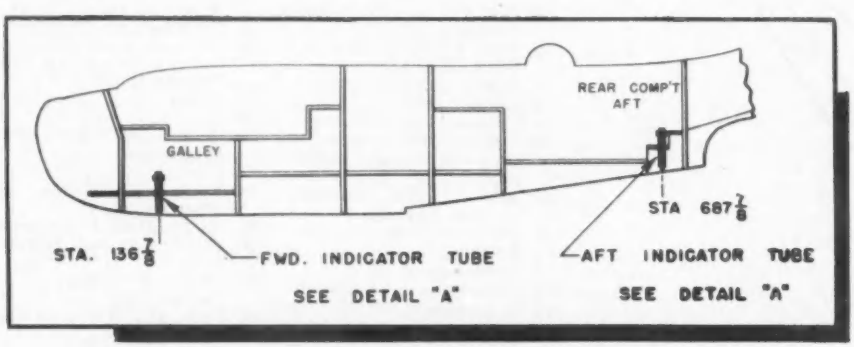


Diagram of its installation

Finer Things
Are Coming Out of the Ground

From the ore ranges, the coal fields, and the limestone beds are coming vast quantities of blended iron ore, coking coal, and purest limestone—the principal ingredients for making steel, the "master metal" in both peace and war.

Today this steel must all go into the production of the materiel of war, but tomorrow, when Victory is ours, finer things will come to us from out of the ground because of improvements now being made in steel.

Inland metallurgists are constantly testing and re-testing, melting and re-melting, adding one element and taking away another—always seeking for something better. Already they have contributed many new methods and new steels to production for war.

These, and the newer methods and Inland steels that are sure to come from continued intensive research, will help you meet the needs of America at peace.

INLAND STEEL COMPANY

38 South Dearborn Street, Chicago 3, Illinois

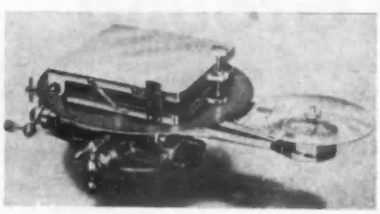
Milwaukee · Detroit · St. Paul · St. Louis · Kansas City · Cincinnati · New York

New Production Equipment

A QUARTZ orientation replacement table, adaptable to any quartz cutting saw, is announced by the Robert H. Clark Company, Beverly Hills, Cal. The table is used in positioning the quartz to facilitate extreme accuracy for cutting the crystals used in electronics; radio, radar, sound detecting and locating devices. This table is used in the manufacture of the crystal oscillators for which this war has created an unprecedented demand.

Correction readings may be transferred from either General Electric or Phillips X-Ray machines directly to the 10½-in. degree dial on the table. The minute calibrations on the adjustments are easily visible, and large enough to allow corrections to a fraction of a second.

The table can be rotated 360 deg. and provisions are made for the "X" correction with a plainly visible scale and pointer. The tables and mechanism

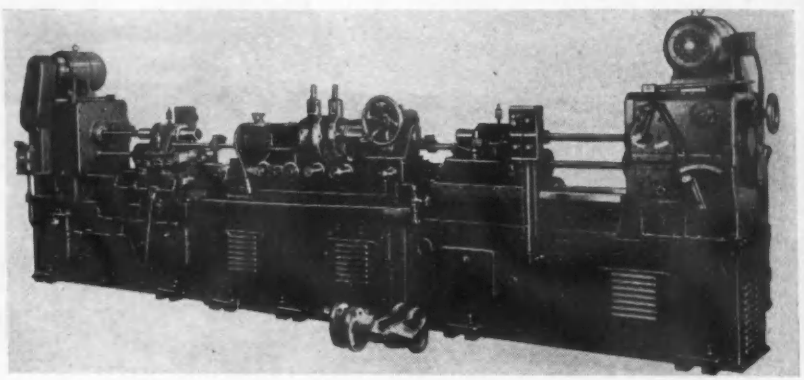


Clark quartz orientation replacement table

are chromium-plated cast bronze, designed to minimize wear from vibration and avoid inaccuracies. Adjustments are provided to compensate automatically for wear. Spring-loaded gears in the gear-train eliminate backlash, thereby assuring setting to minute precision. The gears on the sector-arm and the gear-train are meshed under constantly maintained tension to eliminate any inaccuracies due to tooth wear. The gear case is protected by a Lucite cover to prevent quartz loaded coolant from getting into the gear mechanism.

A SPECIAL two-way reaming, counterboring and tapping machine has been developed by Snyder Tool & Engineering Company, Detroit, Mich., for reaming, counterboring and left and right hand tapping aircraft crankshaft sections after assembly.

The principal distinguishing feature



Special Snyder reaming, counterboring and tapping machine

of this machine is its horizontal design which results in the machine being built in three sections—a central section carrying the fixture and two end sections carrying spindles, drives and slides.

Each end of the machine is, in effect, an individual machine performing a complete set of operations upon one end of the workpiece. Thus, both ends of the workpiece are processed simultaneously with but one loading and unloading operation.

The slides for reaming and counterboring have hydraulic feed, while tapping is by a lead screw after hydraulic rapid approach. The fixture is manually operated and tools are exchanged between successive operations. Each tool and operation has its own individual lever setting on the drive unit and the machine automatically selects the correct speed and depth for each tool throughout the automatic work cycle.

F. J. LITTELL MACHINE CO., Chicago, Ill., is producing a new Powertilt reel to replace manually loaded wire reels. Easy loading of coil is due to drop-center and motor drive which does the work of elevating the coil from the floor up to the working level. The Littell Powertilt wire reel elevates the coil automatically. A turn of the control lever causes the motor to start and elevate the reel. When the reel has reached its upright position the motor stops. A push against the coil centers it, and then the drop center is locked by throwing over a u-shaped bar.

Drop-center of the reel permits the operator to roll the coil upon the floor and tip the coil of wire onto the reel core, and it is ready to be power-lifted.

In lowering the reel to loading position, the operator turns the control handle, which is located on the end of reel spindle, and then the reel descends by power and shuts off automatically.

Main gears of reel are enclosed in a transmission case and mounted on ball bearings. A V-belt drive is used from the motor. A standard NEMA frame motor is used, permitting the use of any standard 1/3 .hp, 1725 rpm motor on the unit.

A PORTABLE, self-contained unit for collecting dust from flexible shaft grinding, and lint and dirt from similar buffing and polishing operations is now in production at Aget-Detroit Company, Ann Arbor, Mich.

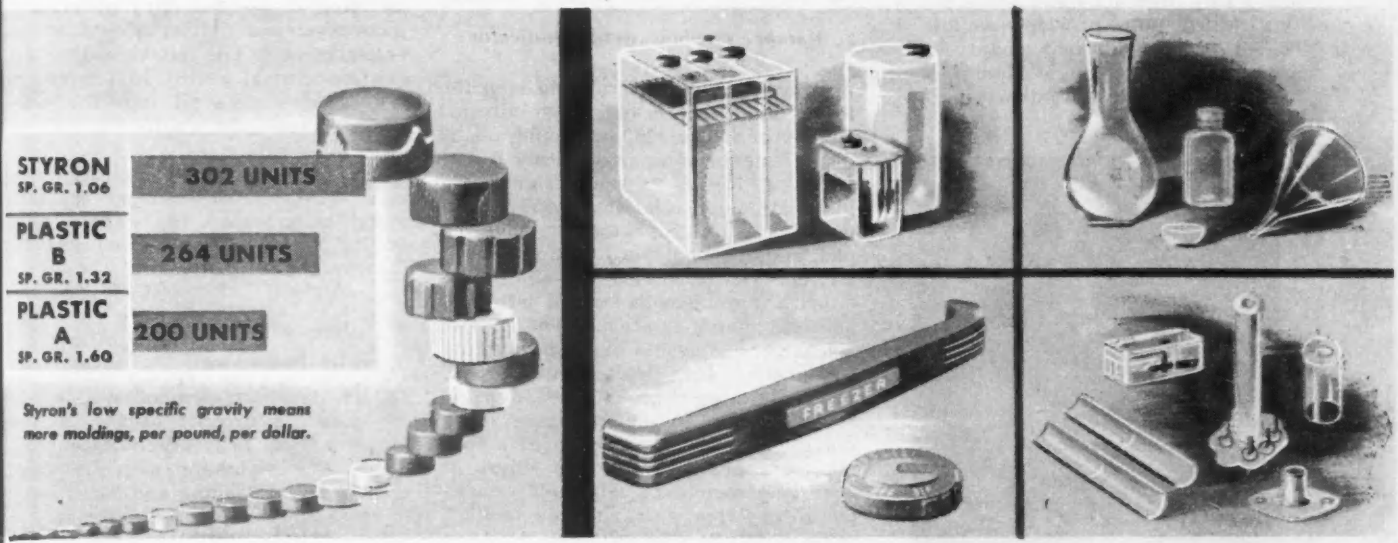
The new equipment consists of two separate units; the wood bench with backstops of sheet metal to stop heavy particles and add efficiency, and the self-contained Dustkop which has its

(*Turn to page* 90, *please*)

Littell Powertilt wire reel

Why you should plan NOW to use Polystyrene

Huge war output of styrene holds this promise to Polystyrene users—a *top-ranking* plastic—at a *low price*—for *volume* production.



Today, all of us have but one objective—the winning of the war. Tomorrow we also have a great responsibility in the return to a peacetime economy—the responsibility to produce more and better products at a lower price. For these reasons plan now to use Styron (Dow Polystyrene). Large production facilities will make this versatile plastic available in a quantity, of a quality and at a price to meet the exacting needs of a product-hungry world.

The qualities of Styron have long since proved themselves in costume jewelry, colorful dishes, low-cost optical lenses, in precision products demanding low water absorption, in acid-resistant bottles and closures, and in high frequency electrical equipment. These are but a few jobs where Styron stands out. They suggest Styron's adaptability and wide range of usefulness. New forms will also be available for exciting and entirely different applications.

THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland • St. Louis • Chicago
Houston • San Francisco • Los Angeles • Seattle

DOW PLASTICS INCLUDE

STYRON . . . for fabricators producing moldings, extrusions, rod, sheet.
ETHOCEL . . . for fabricators producing moldings, extrusions, coatings; available also as Ethocel Sheeting.
SARAN . . . for fabricators producing moldings, extrusions, pipe, tubing, sheet; available also as Saran Film.

Write for new Dow Booklet "A Practical Approach to Plastics."

STYRON

(DOW POLYSTYRENE)

DOW
CHEMICALS PLASTICS MAGNESIUM
INDISPENSABLE TO INDUSTRY AND VICTORY

New Products for Aircraft

Portable, Self-Powered Warm Air Furnace

A portable self-powered, automatic forced warm air furnace, weighing 45 pounds and comparable in size to an average traveling bag, has been developed for the Army Air Forces for a variety of undisclosed ground and flight applications by Norge Division of Borg-Warner Corporation, Detroit, Mich.

Equipped with its own fuel supply and a tiny precision-built prime mover, this sealed unit provides a flow of heated air in sufficient quantities to keep an average single family home warm in the coldest weather.

Norge Portable warm air furnace

In tests conducted at the United States Bureau of Standards in its high Altitude Chamber and in the Low Temperature Research Chamber at Northwestern University, the Norge unit is said to have operated successfully at five miles altitude and with temperatures as low as 70 degrees below zero.

Eclipse Aviation Engine Starter

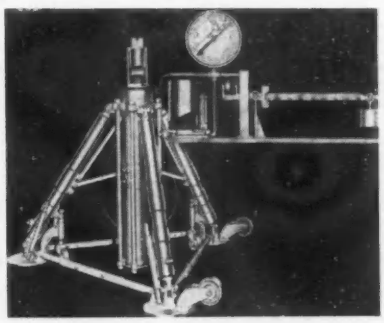
Eclipse - Pioneer Division, Bendix Aviation Corp., Teterboro, N. J., has released a new Series 43 inertia and direct cranking electric starter which provides high initial cranking rpm followed by direct cranking to aircraft engines of 450 to 1200 hp having piston displacements of approximately 670 to 1860 cu in. They are designed for installation on aviation engines incorporating a 6 in. SAE starter mounting pad, and are available for 12 or 24-volt d-c, one-wire grounded operation, with either a 3 or 12-tooth jaw for left hand or right hand rotation. The starter mechanism consists of a heavy-duty accelerating and direct cranking electric motor, precision-balanced flywheel keyed directly to the armature shaft, reduction gearing, consisting of a four planetary gear set and two stages of spur gear reduction, adjustable multiple disc clutch, engaging mechanism, baffle plate and starter jaw.

Assuming a nominal engine cranking torque of 225 lb ft, the Series 43 electric starters will provide an initial cranking speed of 110 rpm followed by direct cranking at 35 and 48 rpm for 12 and 24-volt starters respectively with minimum current consumption.

The starters provide for any operating contingency; both the inertia and direct cranking features are used for normal operations; the direct cranking feature only for warm engine starting; the inertia feature only when batteries are low; and manual hand cranking for emergency starter operation.

A brush spring tension release mechanism permits release of the brush spring tension when manual hand cranking of the starter is desired, and an integral solenoid relay provides remote electrical control of starter jaw engagement. The multiple-disc, dry, friction clutch, sealed to prevent entrance of engine oil into the clutch pack, protects the starter in the event of undue loading.

Concentric in design, 7 in. in diameter, 11¼ in. long from mounting flange to backhead, the starters weigh 32 lbs for the 12-volt unit, and 33.9 lbs for the 24-volt unit.

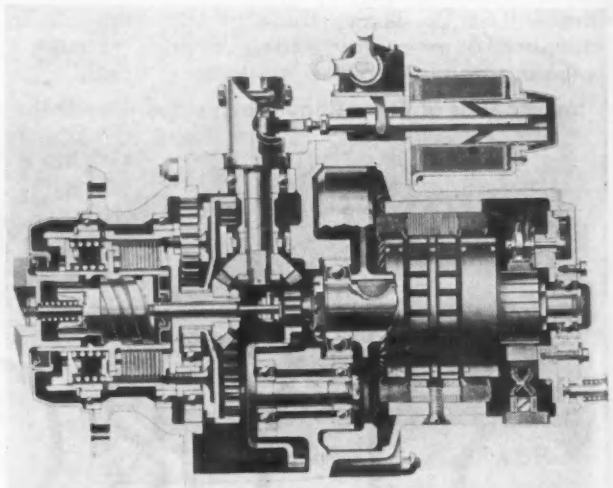


Malabar airplane weight indicator

Malabar Airplane Weight Indicator

THE Malabar airplane weight indicator, a product of the Malabar Machine Co., Los Angeles, Cal., is a device for weighing airplanes when empty, during loading and fully loaded, to check the center of gravity. It consists of three units, each of which is comprised of a hydraulic cylinder, connecting hose, pump, oil reservoir, pressure gauge and beam scale. The hydraulic cylinder fits into a socket in the head of the plunger of any Malabar

(*Turn to page* 67, *please*)



Eclipse Series 43 inertia and direct cranking electric aviation engine starter

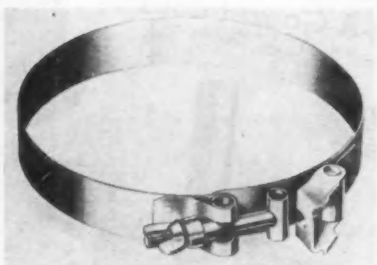
Flexible at Extreme Temperatures!
In the sub-zero cold of the stratosphere . . . often dropping to 70 or 80 degrees below zero . . . Permatex Aviation Form-A-Gasket does not become hard, crack or fly to pieces.
In the high temperatures of the desert . . . often reaching 140 or 150 degrees above zero . . . Permatex Aviation Form-A-Gasket does not melt or run.
Permatex Aviation Form-A-Gasket is a heavy liquid that flows smoothly from the brush and is easy to apply. It produces a non-drying, flexible seal that is leak-proof to fuels, lubricants and other liquids used in internal combustion engines. It disassembles very readily.
Used in the machines of war and in the machines of peace!
PERMATEX
AVIATION
FORM-A-GASKET
(LIQUID)
PERMATEX COMPANY, INC. Sheepshead Bay, N. Y., U. S. A.

New Products

Quick-Coupler Clamp Permits Full Adjustment

"Quick-Coupler," a new type clamp produced by Marman Products Co., Inc., Inglewood, Cal., combines a snap-on latch with the full adjustment of a standard clamp, all in one unit. This design permits the instantaneous removal of the clamp or its quick installation.

The new "Quick-Coupler" is available in all sizes, in aluminum alloy and stainless steel, and in shapes to fit all convex surfaces. It may be had with self-locking, plain hex, or wing nuts.



Marman Quick-Coupler Clamp

The "Quick-Coupler" embodies Marman's patented design, which permits the application of a uniform radial pressure to the periphery of the parts over which it is installed and its rugged construction allows re-use without efficiency loss.

Grease and Oil Remover

The problem of finding a clean, convenient, effective and sanitary way of removing oil and grease from the hands and arms, is said to be satisfactorily solved by a product called "Flix," developed by Waverly Petroleum Products Company, Philadelphia, Pa., and Refiners Lubricating Company, New, York, N. Y.

Flix is a hand-sized, semi-quilted pad containing a remarkably effective absorbent substance that quickly removes all types of oils from the skin, leaving it clean and dry.

The manufacturers claim many advantages for it; it helps prevent skin diseases, it is economical, it is safe (due to the fact that it will not burn and has no loose ends to catch in machinery), it is sanitary, it is useful in removing oil from machine parts preparatory to painting, and it speeds cleaning and saves soap.

Combined Cleaner and Rust Preventive

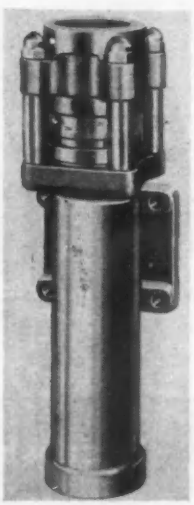
A combined rust preventive, cleaner and fingerprint neutralizer is offered by E. F. Houghton & Co., Philadelphia, Pa., for use in internal plant protection of steel parts between processing or machining operations.

This product—Cosmoline No. 805—is intended not to remove rust, but to neutralize the causes of corrosion, particularly acid perspiration from workers handling the parts. It also is effective in protection against corrosion caused by high humidity, fumes, or a chemical atmosphere.

Cosmoline No. 805 is a fluid product which conforms to requirements of Ordnance Technical Manual TM 38-305. It will meet and exceed 24-hr. salt spray and 100-hr. humidity tests.

New Gage Indicates Rate of Fluid Flow

A new precision Flogage which continuously indicates the rate of fluid flow, is announced by Hydraulic Machinery, Inc., Dearborn, Mich. The design of this device permits actuation of the indicating dial by the kinetic energy of the fluid flowing through the gage. Briefly described, its mechanism consists of an indicating dial constructed as an impeller, the rotary movement of which is resisted by a precision torsion bar. The "Hy-Mac" Flogage" is insensitive to changes in fluid viscosity, fluid temperature or fluid pressure. It is accurate to within a fraction of 1 per cent and can be constructed to withstand any internal pressure without effecting its accuracy. An adjustment is provided to permit measurement of the flow rate for fluids of different specific gravities. The Flogage is adaptable to any capacity and the design allows extremely low weight and overall dimensions in ratio to GPM flow capacity. The unit illustrated has a capacity of 60 GPM and is 3 7/16 in. by 13 15/16 in. overall.



Hy-Mac Flogage

Compar glove

Compar Clothing Protect Workers

Flexible transparent garments are now available made of a vinyl resin known as compar, a product of Resistoflex Corporation, Belleville, N. J. This material is a limestone-coal-and-air derivative which is impervious to sulphur-base cutting oils, kerosene, paint, lacquer, cleaning and degreasing compounds, and other organic solvents. The clothing is also unaffected by many of the inorganic solvents. Workers who

(*Turn to page* 102, *please*)

MODERN designers have incorporated Formica Decorative Sheet in streamlined train interiors, restaurants, soda fountains, bars, ships and shops. Because it comes in a wide variety of styles and colors—fits into any decorative scheme—and adds that final touch of color, beauty or distinction which produces SALES.

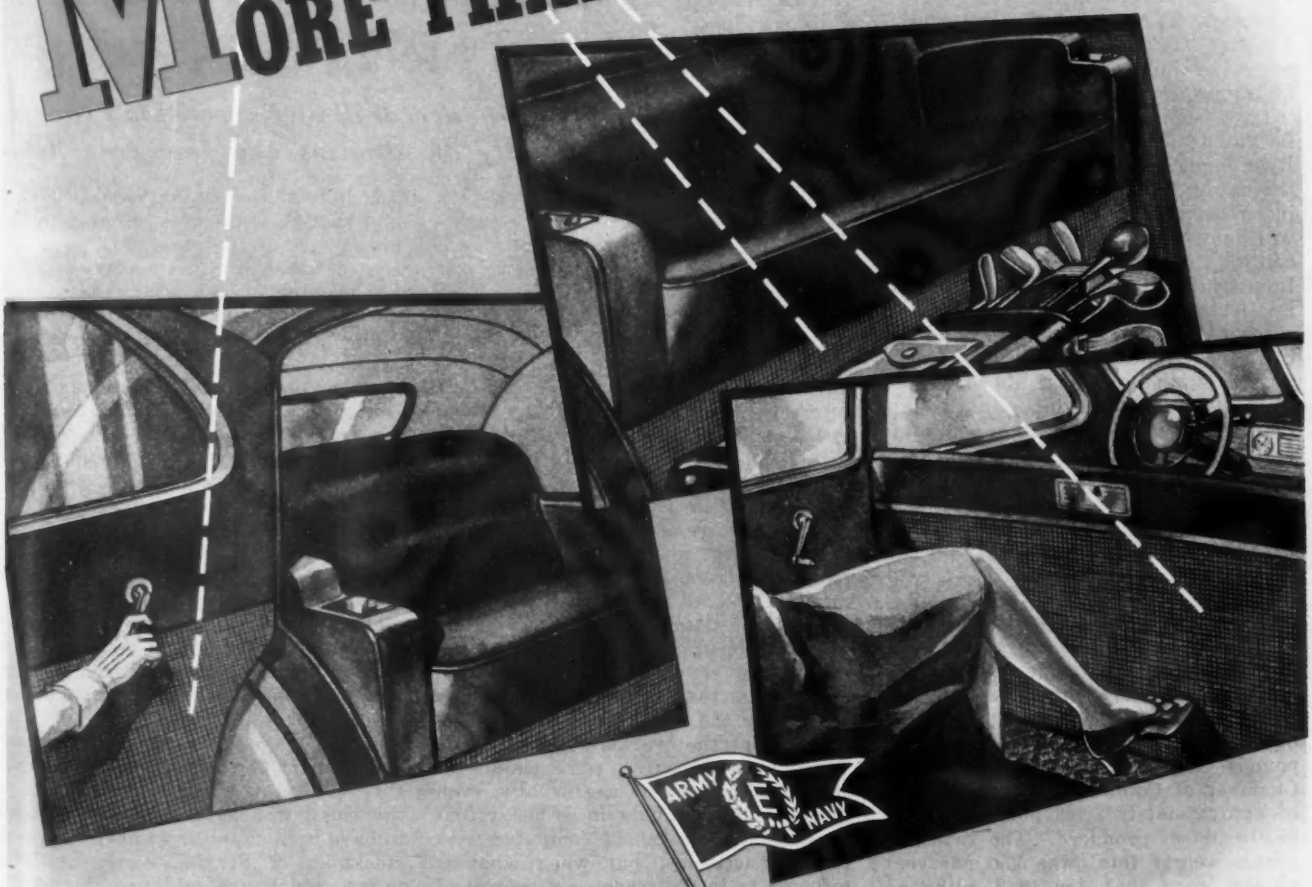
But Formica Decorative Sheet is designed to meet MORE than the eye. On the door panels of your post-war masterpiece, it meets Milady's white-gloved hand. On the back of front seats, it meets her white shoes. FORMICA meets them—and keeps them clean!

For FORMICA is impervious to dirt and dust, grease and grime—is easily washed or dusted.

Formica Decorative Sheet will not scuff or scratch or wear with ordinary family or commecial use. Golf clubs, picnic baskets, luggage or samples which quickly wear through or tear through fabrics will not harm Formica. For ease of upkeep, lasting sparkle and long life—specify "Interior finished in Formica Decorative Sheet".

"The Formica Story" is a moving picture in color showing the qualities of Formica, how it is made, how it is used. Available for meetings of engineering, production or sales men.

MORE THAN MEETS THE EYE!



THE FORMICA INSULATION COMPANY

4512 SPRING GROVE AVENUE, CINCINNATI 32, OHIO

FORMICA

Aircraft Has Become Principal Product of Automotive Industry

Los Angeles Still Tops the Nation in Airplane Production, Newark-Jersey City Area Second on List

Aircraft is the No. 1 item on the nation's war production program for 1944 and it also has become the principal product of the automotive industry. Aircraft comprised 42.8 per cent of the automotive industry's war deliveries in the fourth quarter of 1943 compared to 22.8 per cent in the first quarter of 1942, just after Pearl Harbor. The current rate of aircraft production by the automotive industry is eight times what it was in the first three months of 1942. Since the defense program got under way in May, 1940, the automotive industry has produced nearly $5 billion worth of aircraft, including engines, airframes, equipment and parts.

Los Angeles, site of the Douglas, Lockheed, Vultee, North American, Ryan and Northrop plants, still tops the nation in airplane production, having received more than $6 billion in war contracts up to October, 1943, according to a survey by the National Industrial Conference Board. The Newark-Jersey City area, which includes several Curtiss-Wright, Bendix and GM Eastern Aircraft Division plants, stands second on the list, just ahead of Detroit, both areas having slightly less than $3 billion in aircraft orders. Buffalo, where Bell, Curtiss-Wright and Chevrolet have several large factories, and San Diego, site of the vast Consolidated-Vultee establishment, rank next with about $2½ billion each.

Increasing emphasis on such heavy planes as the B-29, B-17 and B-24 bombers and huge transports like the C-54, C-69 and Martin Mars is evident in the greater poundage and smaller numerical increase proportionately of the 1944 aircraft program. Airplane output in 1943 totaled 667,000,000 pounds, according to the Aeronautical Chamber of Commerce, or an average of approximately 7,760 pounds for the 85,919 planes produced. The 1943 airframe weight total was 250 per cent greater than that for 1942, although the numerical gain was only 80 per cent. Average airframe weight in 1942 was 5,790 pounds. Last December's output of 8802 planes averaged 9739 pounds apiece and this rate of production will have to be increased 18 per cent, or an average of 11,455 pounds, to meet the 1944 schedule of 100,000 planes. The 1944 aircraft program calls for an increase in total airframe weight of about 50 per cent over 1943 production but the numerical increase is only 20 per cent. The more than 100,000 planes scheduled for 1944 will be equivalent in weight to about 167,000 of the earlier types. January's output of 8789 planes fell off 13 planes from the December total, but every company met or exceeded schedules. Tactical aircraft represented 82 per cent of the month's production, and 89 per cent of the tactical classification were in combat types. On an airframe weight basis, January's production gained 5.4 per cent over December and the average plane weight climbed to 10,274 pounds.

Pacific Coast aircraft plants produced 26,636 planes in 1943, 31 per cent of the national total and an increase of 50½ per cent over 1942 output of 17,694 planes. On an airframe

(*Turn to page* 172, *please*)

No OPA Approval of Uniform Stepping Up of Steel Prices

Each Producer Will Be Expected to Prove the Necessity of Allowing the Increases Asked

By W. C. Hirsch

Pre-war automobile manufacturers are taking the keenest interest in the piecemeal steel price adjustment program that Washington has decided on. This is taken as indication that the outlook for approval of a gradual reconversion policy is brightening. While automotive war contractors are deeply interested in the price of steel that goes into military and naval requirements, inquiries in recent weeks indicate that there is more thinking of the cost of steel for initial post-war civilian requirements. Those who are steeped in the intricacies of steel price formulas doubt whether the present inquiry into steel production costs can yield more than a stop-gap approach to the problem. What makes cost-finding in the steel industry so involved a task, is that costs are materially altered by the size of the tonnage demand for the various descriptions. There are, of course, some classes of steel products, which are usually, even in peace times, bought in so heavy tonnages that costs can be computed with relative accuracy, but when what is referred to in the trade as a poor steel year comes along, cost per unit of even the most stabilized descriptions begins to waver.

That cost consciousness is again coming to the fore among steel buyers is considered an encouraging symptom in the market. It is expected that before March 1, OPA will have before it cost schedules of the leading steel producers and that the task of approving or disapproving of requests for price increases will then get under way. It has been made quite plain that a price increase by product, a uniform stepping up of quotations of all producers, will not receive OPA's approval, each producer being expected to prove the necessity of allowing increases asked. The higher wage scales of steel mill operatives are expected in many cases to bring demands for identical mark-ups by a number of producers. Recent increases in the steel industry's weekly operating rate to very close to capacity are explained in the market as having no significance other than that completion and shipment of armaments for both the European and Asiastic theaters of war are being hastened in keeping with the quickened tempo of the fighting.

Initial shipments of tin from the Government-financed smelter at Texas City are being made to consumers in the East, who heretofore are reported to have been supplied from Government stockpiles of Straits, Banka and Katanga, which are said to be still considerable. The object is to give Eastern consumers an opportunity to become acquainted with the properties of the different grades of tin turned out at the Texas City plant. Until now the Texas City product was distributed almost entirely among Middle West consumers.

2 Basic Reasons for SEALED POWER QUALITY

1 PERSONNEL. For over 30 years Sealed Power has been building an organization of exceptional competence—from engineers and metallurgists to foundrymen and women inspectors.

2 FACILITIES. In all the world there are no finer facilities devoted to the production of piston rings, pistons and cylinder sleeves than those of Sealed Power.

Our engineering staff and laboratories are at your service in making good engines even better.

SEALED POWER CORPORATION

Muskegon, Michigan • Windsor, Ontario

SEALED POWER PISTON RINGS

PISTON RINGS—PISTONS—CYLINDER SLEEVES

UAW-CIO Reveals Plans for Industry-Wide Wage Agreements

Wants Master Wage Pattern Through Job Evaluation Without Regard to Products Made or Plant Location

Details on the plans of the UAW-CIO for industry-wide wage agreements based on equal pay for equal work were revealed in the union's brief submitted to the three-man WLB fact-finding panel which concluded hearings Jan. 19 at Detroit over renewal of the contract with General Motors. The union's proposed program for wage stabilization would set up a tripartite wage commission, representing the public, industry and labor, which would survey the automotive and kindred industries and subdivide them into classifications based on type of production and work performed. A master wage pattern would be established through application of job evaluation without regard to products being manufactured or geographical location of the plants.

In the GM case, the UAW-CIO pointed out that uniformity of wage rates is being applied in a large degree in the tool and die classifications at GM plants in Detroit, Pontiac, Flint, Lansing, Toledo, Cleveland, Dayton, Chicago, LaGrange, Ill., Tarrytown, N. Y., Linden and Trenton, N. J., and Baltimore. The union also stated that the same principle of equal pay for equal work is being carried out in one of the lowest labor classifications, that of sweeper, in GM plants throughout the country.

With this in effect, the union maintained that there is no reason for not applying the same principle to other job classifications. Wide wage differentials exist in other job groups, according to the union. Early in the war conversion period, employes at the Chevrolet plant in Flint obtained temporary employment at a Flint Fisher Body plant and were paid $1.29 per hour on armor plate arc welding. Later they were recalled to their old jobs at Chevrolet and paid only $1.14 per hour for identical work. After negotiations before the WLB, the Chevrolet rates were set at $1.24 to $1.34 per hour for this work. Ford plants at Detroit paid $1.25 per hour for armor plate arc welding, while Chrysler plants in Detroit pay $1.27 per hour for similar work. Since the government is paying the bill for all war work, says the union, the rates for equal work should be the same.

However, the UAW-CIO undoubtedly is more interested in applying this industry-wide wage agreement principle to the post-war period to simplify its bargaining problems. Instead of the automotive industry having thousands of individual plant wage negotiations before the WLB, or the NLRB in peacetime, there would be only one industry-wide agreement. Cost-of-living adjustments and other considerations would be applied to this master wage pattern. Any new job classification would be established through job evaluation, giving proper consideration to job content factors such as skill, accuracy, responsibility, physical effort and fatigue. The tripartite wage commission would set up tripartite machinery to administer the master wage agreement on a regional basis under the UAW-CIO proposal. Such a plan would minimize labor discontent by removing wage differentials and thus boost morale, and increase labor productivity, according to the union.

Incentive pay also was an important topic at the panel hearing on the GM and UAW-CIO contract. In urging the union to drop its opposition to incentive pay, which was voted upon favorably last October at the Buffalo convention, GM asserted that it would increase production 10 to 25 per cent without need for additional manpower. GM introduced the production records of 13 plants under UAW-CIO contract which had boosted output after adopting an incentive pay plan. GM cited production increases of 27 to 67 per cent at the Aeroproducts Division, Dayton; 23 to 90 per cent at the Harrison Radiator Division, Lockport, N. Y., and comparable increases at other divisions such as Hyatt Roller Bearing, Rochester Products and Chevrolet Gear & Axle. Walter Reuther, of the UAW-CIO, countered that the workers were opposed to incentive pay and feared they would work themselves out of their jobs. He said the local at Harrison Radiator has asked elimination of the incentive plan in coming hearings before the WLB and cited the experience of hammermen at Chevrolet Gear & Axle who saw their piecework earnings dwindle in 1942 as compared to 1941.

Four of six Detroit plants in the Chevrolet Gear & Axle Division were the scene of a two-day wildcat strike that made 6,500 employes idle, halting production of aircraft, military truck and gun parts. Six employes in the Weiss joint dept. were sent home for failure to meet a new production standard of 8¼ pieces per hour which had been agreed upon by a union committeeman after the Army requested an increase in truck output. The previous standard was 6.6 pieces per hour. Other employes walked out in sympathy and finally four plants closed down. R. J. Thomas, president of the UAW-CIO, ordered the men back to work, declaring it was a clear violation of the contract but another day elapsed before production resumed. The settlement included provision for disciplinary action against the strike leaders and agreement to meet the new production standards.

Sporadic strikes continue to beset the Ford Motor Co., there being no less than four in a recent five-day period. A grievance over the disciplining of a worker who punched out two time cards resulted in a one-day strike that made 5,600 idle at the Highland Park plant, which manufactures air-

(*Turn to page* 56, *please*)

NSPA Headquarters Moved to Chicago

Headquarters offices of the National Standard Parts Association were moved early in February from Detroit to Chicago. The organization now occupies the thirty-fifth floor of the Willoughby Tower Building at 8 South Michigan Avenue. There will be no change in executive staff personnel although plans call for enlargement of the headquarters force during the current year.

Since it was organized 20 years ago, NSPA headquarters had been maintained constantly in Detroit. However, association officials for some time had been of the opinion that original advantages of headquartering in the nation's motor capital no longer existed and that interests of the membership and the after-market industry as a whole could be served most efficiently from a more centrally located point.

Operation of the coordinating office in Washington, D. C., will continue as before with no change in location. This office is at 315 Woodward Building.

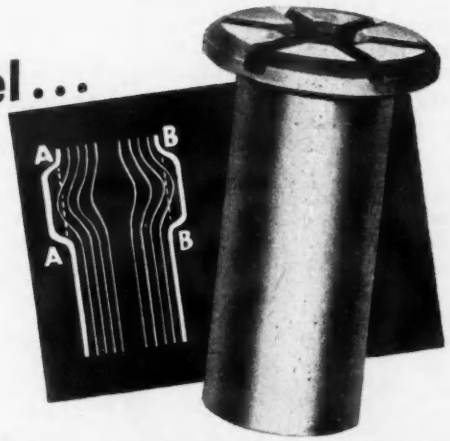
Complex Panel

Engineer's panel of the Navy's newest giant flying boat, Mars, which recently completed its first war mission.

HERE'S A GOOD WAY to help your designers and production men get the most from Stainless Steel...

For useful information that can help you and your men do a trouble-shooting job along the production line, get in touch with your nearby Carpenter representative. He can provide fabricating hints—and technical data to help your engineers get the most from the properties of various types of Stainless Steel.

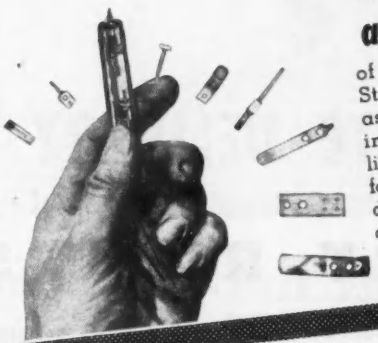
Combine your production-engineering knowledge with Carpenter's diversified experience in solving Stainless problems.



In spite of tremendous pressures and highly abrasive conditions in service—forged knuckle pins like this stay on the job longer because they are made from Carpenter Stainless. And note in the diagram that forging produced an even grain flow throughout, thus strengthening the thin sections at points AA and BB.

Faster Output

of valve parts such as bodies, bonnets and needles is possible when this Stainless is used. Ever since Carpenter invented free-machining Stainless Steels, it has been possible to make Stainless valve parts that help prevent scratching, galling and seizing in service.



Easy Bending and Punching

of hardened Carpenter Stainless Strip helps to assure accuracy in making radio control parts like these. Another reason for using this strip is its dependable *uniformity*, coil after coil.

Quick Answers to your questions about Stainless Steels...

This 98-page book contains practical information to help you speed the production of Stainless Steel parts. It is completely cross-indexed to help you quickly find the answer to your specific problem. Use it to help you get the most from Stainless today—and to plan the use of Stainless in new products that will have to win sales battles tomorrow. "Working Data for Carpenter Stainless Steels" is available to Stainless users in the U.S.A. For your copy, drop us a note on your company letterhead.

The Carpenter Steel Company • 103 W. Bern Street, Reading, Pa.

Carpenter STAINLESS STEELS

...for
Strength
Rigidity
Heat Resistance
Corrosion Resistance
Longer Product Life
Sales Appeal

BRANCHES AT
Chicago, Cleveland, Detroit, Hartford, St. Louis, Indianapolis, New York, Philadelphia

General Electric Sets Safety Record

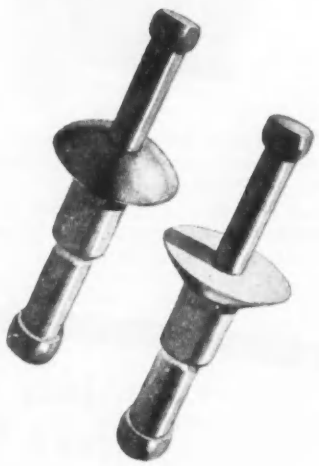
Two of General Electric's manufacturing plants have each established safety records of more than two hundred million man-hours of work without a fatality, believed to be unequalled in any heavy apparatus manufacturing factory in the country, according to George E. Sanford, in charge of the company's safety program.

Since the last fatality in the Schenectady Works, more than two years ago, the plant has worked 211,124,832 man-hours. Close to this record is the Fort Wayne, Ind., Works with 200,272,098 man-hours since its last fatality. If the Schenectady Works' record were applied to a plant of 250 employes, this would mean 350 years without a fatality.

Forum to Study Postwar Materials Handling

A forum to study postwar materials handling has been established by Clark Tructractor Division of Clark Equipment Company, Battle Creek, Michigan, according to an announcement by Ezra W. Clark, vice president and general manager. A survey is being undertaken to obtain from executives in all industry data on the movement and storage of material in their plants. The facts so gathered will be assembled and compiled with a view to engineering materials handling equipment to meet postwar needs.

The belief back of this movement is that the adoption of the fullest possible use of materials handling equipment will release unskilled labor for training in the techniques of quality mass production and thus help to meet the country's future demands for a vastly increased output of quality goods.



NOW

IMMEDIATE DELIVERY★

ON

CHERRY RIVETS

Today Cherry Blind Rivets are plentiful—five times as many rivets as a year ago. Deliveries are current to an increasing number of customers.

In spite of this increase in our production, the quality of Cherry Rivets has been continually improved. Refinements in design and quality control have made Cherry Rivets more uniform—have improved their structural characteristics.

Chances are you can save time and money by using Cherry Rivets in more of the hard-to-get-at places. New types of Cherry Rivets to meet special applications are being developed. Why not put your problems before our Engineering Service Department?

★ We can start shipment immediately on new orders for Cherry Blind Rivets and tools for applying them.

CHERRY RIVETS, THEIR MANUFACTURE AND APPLICATION ARE COVERED BY U. S. PATENTS ISSUED AND PENDING.

Cherry Rivet Company

LOS ANGELES, CALIFORNIA

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE AND AVIATION INDUSTRIES

Renewed expansion of general business activity has been indicated. The seasonally adjusted index of *The New York Times* for the week ended Jan. 22 rose to 148.2, as against 146.8 in the preceding week and the all-time peak of 148.7 recorded at the beginning of December.

Department store sales during the fourth week of January, as reported by the Federal Reserve Board, declined from 136 to 130 per cent of the 1935-39 average. Total values recorded were 8 per cent above the corresponding figure in 1943, and sales for the four weeks ended Jan. 29 were 6 per cent above the total a year earlier.

Railway freight loadings during the week ended Jan. 29 totaled 811,062 cars, 1.5 per cent more than the preceding weekly figure and 10.4 per cent above the comparable number in 1943.

Production of electric power during the same period declined less than seasonally, but the total was 13.8 per cent above the output a year ago, as against a similar excess of 14.0 per cent recorded a week earlier.

Crude oil production in the week ended Jan. 29, continuing a recently resumed expansion, averaged 4,409,450 barrels daily, 20,250 barrels above the figure for the week before but 20,150 barrels less than the average recommended by the Petroleum Administration for War.

Production of soft coal during the week ended Jan. 22 was estimated at 12,650,000 net tons, 0.8 per cent less than the preceding weekly figure but 12.9 per cent greater than the output a year earlier.

Engineering construction contracts awarded during the week ended Feb. 3 totaled $35,523,000, as against $33,241,000 a week earlier, according to *Engineering News-Record*. Contracts for public projects were 77 per cent below the comparable amount in 1943, while private construction registered an advance of 85 per cent; and the contract total equals less than half the sum reported a year ago.

The Irving Fisher index of wholesale commodity prices for the week ended Jan. 28 was unchanged at 112.5 per cent of the 1926 average, as compared with 110.3 a year ago.

Member bank reserves declined $155,000,000 during the week ended Feb. 2, but excess reserves rose $520,000,000 to an estimated total of $1,540,000,000. Business loans of reporting members increased $20,000,000 in the preceding week and stood $220,000,000 above the total a year earlier.

Tank men can't keep cool—but their oil must!

Yankee engineering skill licks another tough problem

Outside it's 120°. Inside—well, how hot is a blast furnace? Your helmet is lead. The sweat streams down your back.

You're taking real punishment. And so is your General Sherman.

If anything can keep cool in this inferno, you're glad it's that big engine back there. A conked-out tank is meat for anti-tank guns!

But her splendid motor roars on. You bless the lads who built each vital part. She's the best!

Special oil coolers for these tank motors that must perform under extreme conditions of temperature and terrain are among the more than 100 war items being produced today by Borg-Warner companies.

Many of these products are going to the fighting fronts in material produced by your industry. And, as in our peacetime work with you, our guiding principle in this wartime partnership is—"design it better—make it better."

This is the principle which we will carry forward into the post-war world when your energies and ours will again be teamed to supply the tremendous accumulation of civilian needs.

Partners with the automotive and aviation industries in peace and war, Borg-Warner supplies these and other essential parts . . .

CLUTCHES AND CLUTCH PARTS
GEARS
UNIVERSAL JOINTS AND DRIVE SHAFTS
TRANSMISSIONS
CARBURETORS
TIMING CHAINS
PUMPS
RADIATORS
AVIATION STEEL

ENGINEERING B-W PRODUCTION

BORG-WARNER

Peacetime makers of essential operating parts for the automotive, aviation, marine and farm implement industries, and of Norge home appliances . . . these companies which form the Borg-Warner Corporation are today devoted exclusively to the needs of war: BORG & BECK • BORG-WARNER INTERNATIONAL • BORG-WARNER SERVICE PARTS • CALUMET STEEL • DETROIT GEAR • AIRCRAFT PARTS • INGERSOLL STEEL & DISC • LONG • MARBON • MARVEL-SCHEBLER CARBURETER • MCCULLOCH ENGINEERING • MECHANICS UNIVERSAL JOINT • MORSE CHAIN • NORGE • NORGE MACHINE PRODUCTS • PESCO • ROCKFORD CLUTCH • SPRING DIVISION • WARNER AUTOMOTIVE PARTS • WARNER GEAR

Awards

Names and winners of Army-Navy "E" awards in or allied with the automotive and aviation industries, announced since the Feb. 1 issue of AUTOMOTIVE AND AVIATION INDUSTRIES went to press.

AIR-MAZE CORPORATION, Cleveland, Ohio.

CARLTON LAMP CORPORATION, Newark, N. J.

E. I. DU PONT DE NEMOURS & COMPANY, INC., Electrochemicals Dept., Wyandotte Plant, Wyandotte, Mich.

EDLUND MACHINERY COMPANY, INC., Cortland, N. Y.

KEWANEE MACHINERY & CONVEYOR COMPANY, Kewanee, Ill.

THE OSBORN MANUFACTURING COMPANY, Cleveland, Ohio.

"E" Star Awards

for continued meritorious services on the production front have been awarded to the following firms:

MECHANICS UNIVERSAL JOINT DIVISION, Borg-Warner Corp., Rockford, Ill.

BURGESS-NORTON MFG. CO., Geneva, Ill.

H. M. HARPER COMPANY, Chicago, Ill.

A. F. HOLDEN COMPANY, New Haven, Conn. (two plants).

A second gold star for continued achievement in completing wartime schedules has been added to the Maritime "M" Pennant of The Cooper-Bessemer Corp., Cleveland, Ohio.

Obituary

William B. Mayo, 78, formerly chief construction engineer of the Ford Motor Co., died Jan. 31 at Detroit following a short illness. After selling some power plant machinery to Ford in 1912, he joined the Ford organization and supervised the building of the power plant at the Highland Park plant. When Ford moved his operations to Dearborn, Mayo directed the construction of the giant Rouge plant. He directed the electrification of the Detroit, Toledo & Ironton Railroad after Ford bought it and also the building of the Ford ore freighters. He also directed the construction of many assembly plants and other projects for Ford throughout the country. He retired from his Ford position Sept. 1, 1932. He was president of the Chicago, Duluth & Georgian Bay Transit Co. and a member of the Michigan State Board of Aeronautics at the time of his death.

Arthur G. Bishop, 92, director and former vice president of General Motors Corp., died Jan. 22, at Flint, of pneumonia. He had been a GM director since 1915 and was a vice president until 1930. He was board chairman of the Genesee County Savings Bank.

Ernest E. Wilson, 45, director of the General Motors Proving Ground, Milford, Mich., died Jan. 22 at Detroit, after a long illness. He joined GM as a research engineer in 1928 and went to the proving ground in 1936. He had been director of the latter for the past two years. He was a member of the SAE.

Edward J. Frost, 74, founder and former president of the Frost Gear & Forge Co., Jackson, Mich., died Jan. 20 at his home in Jackson after a long illness. He retired as president of the company, now a subsidiary of Clark Equipment Co., in 1929. He was a past president of the American Gear Manufacturers Association and of the Drop Forge Association.

Edward F. Tannewitz, 53, former vice president of the Detroit Gasket Co., died Jan. 21 at his home in Detroit. He formed the Detroit Cord Co. in 1919, which later was merged with Detroit Gasket Co. He retired several years ago.

Maj. William E. Hoke, 78, inventor of the "hoke blocks" for precision measurement, died Jan. 25 at his home in Baltimore.

W. Edwin Palmer, 69, secretary and assistant treasurer of Seiberling Rubber Co., and a rubber industry pioneer, died in Akron City Hospital, January 25, after a short illness following an operation.

Frederick J. Macwilliams, 49, general manager of Abart Gear & Machine Company, Chicago, died January 23, after a long illness.

CALENDAR

Conventions and Meetings

American Society for Testing Materials Spring Meeting, Cincinnati, Feb. 28-March 3

American Society of Tool Engineers—Annual Mtg., Philadelphia.March 26-28

American Chemical Society, Cleveland, April 3-7

Midwest Power Conference, Chicago, April 13-14

American Chemical Society Spring Mtg. of Div. of Rubber Chemistry, New York City April 26-28

Institute of the Aeronautical Sciences—Natl. Light Aircraft Mtg., Detroit, April 27

American Society for Testing Materials (47th Annual Meeting), New York City June 26-30

PUBLICATIONS

A new booklet called **Recharging Instructions for Carbon Dioxide Extinguishers** has been published by the C-O-Two Fire Equipment Co. The pocket-size booklet is illustrated with detail drawings of the equipment required for recharging and the procedure to be followed in recharging both system cylinders and portable extinguishers made by the company.*

A new catalog devoted exclusively to **riveting tools** and equipment has been announced by the Emerson Engineering Co. It is illustrated and divided into sections and indexed for ready reference. Sections included are on rivet sets, squeezer sets, dimpling tools, etc.*

The **DoALL Continuous Band Filing Machine** is described and illustrated in a 4-page bulletin released by Continental Machines, Inc. A list of various kinds of DoALL precision file bands available for any filing operation on the band filer is also included in the bulletin.*

Chevrolet Motor Co. has issued a new booklet, **Care and Preservation of Tools and Equipment.** It contains an approved list of essential shop tools, specification of materials for constructing cabinets and general shop equipment inventory forms, etc.*

Johns-Manville has published a new **Fleet Reliner's Manual.** It contains many graphic, easy-to-understand illustrations and covers in detail all basic technical facts on the servicing and maintenance of brake systems in use on all modern, heavy-duty vehicles. It describes the function of every part of every brake and brake control system in popular use today and outlines step-by-step adjustment procedures.*

A new booklet has been issued by Brunner Mfg. Co. on **liquid petroleum gas** transfer. It describes how this vapor can be recovered and methods of speeding up the emptying of tank cars or trucks. It also contains tables and pertinent data of value to users of LP Gas.*

A new catalog on **Morse Silent Chain Drives** has been issued by Morse Chain Co. Included is entirely new material covering the advances and new developments made in the high-speed chain drive, specifications and price lists; a new section on installation and maintenance and condensed data covering other Morse power transmission equipment, etc.*

In the January issue of The Institute Spokesman, published by National Lubricating Grease Institute, is a comprehensive article, **Test Methods for Determining Free Acid and Free Alkali in Greases,** written by Gus Kaufman of The Texas Co.*

Guide for Production Tapping is the title of a 12-page booklet by Cleveland Tapping Machine Co. It contains various useful data, relating to automatic tapping as performed on lead screw tapping machines.*

General Electric Co. has published an application manual, **Liquid-Level Indicating Equipment for Aircraft.** The manual is prepared for aircraft engineers who are responsible for the application of remote-indicating liquid-level equipment, and is designed to assist in the selection and application of both the transmitters and indicators.*

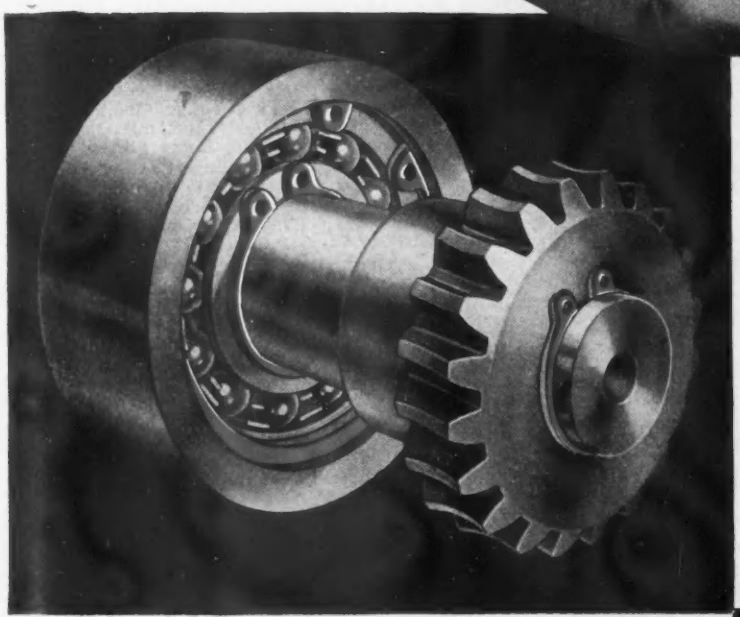
An illustrated booklet on the subject of **carbon seal rings** and their application to the bellows type shaft seals has been issued by Pure Carbon Co.*

Die-Less Duplicating is the title of a new booklet issued by O'Neil-Irwin Co. It describes and illustrates the origin and development of the Di-Arco system, describes new machines and operations, etc.*

* Obtainable by subscribers within the United States through Editorial Dept. AUTOMOTIVE *and* AVIATION INDUSTRIES. In making requests for any of these publications, be sure to give date of the issue in which the announcement appeared, your name and address, company connection and title.

WALDES TRUARC RETAINING RING

U. S. Patent Re. 18144
Sole Manufacturers in U.S.A.



For thrust-load fixing, and shaft and housing applications, Waldes Truarc provides distinct advantages over nuts and bolts or wedges and washers... it reduces dimension and weight... saves material... cuts manufacturing time... simplifies assembly and dis-assembly.

On request, we will gladly furnish samples and full data for your tests.

● Waldes Truarc presents a significant advance in retaining rings.

It spreads or contracts without distortion, always retaining its perfectly fitting circular contour.

WALDES KOH • I • NOOR • INC. ★ LONG ISLAND CITY, N. Y.

PERSONALS

The Trafford Micarta Dept. of the Westinghouse Electric & Mfg. Co. has announced the appointment of **David R. Rennie** as superintendent, **Henry C. Guhl** as engineering manager and **Joseph E. Callahan** as application manager.

Aluminum Co. of America has announced the appointment of **Frank O. Barrows, Jr.,** as automotive sales manager. In this new post, Mr. Barrows will serve as direct contact man between Alcoa and the automotive industry.

Lloyd Ashby has been named personnel manager of the Perfect Circle plant at Richmond, Indiana. He previously held the posts of supervisor of foreman training and assistant educational supervisor of the Richmond plant.

The Institute of the Aeronautical Sciences has announced the election of the following officers for 1944. **Major R. H. Fleet,** president; vice-presidents are **Wellwood E. Beall,** Boeing Aircraft Co.; **William K. Ebel,** The Glenn L. Martin Co.; **Elmer A. Sperry, Jr.,** Sperry Products, Inc., and **G. M. Williams,** Curtiss-Wright. Executive vice-president, **Bennett H. Horshler;** treasurer, **Charles H. Colvin;** secretary, **Robert R. Dexter;** chairman of the council and president of the aeronautical archives, **Lester D. Gardner.**

The Lincoln Electric Co. has announced the appointment of **B. J. Brugge** as welding engineer in the Detroit office. Announcement has also been made of the appointment of **R. H. Davies** as welding engineering representative for Lincoln in Washington, D. C.

The appointment of **Robert E. Behler** as national field sales manager of the Hand Tool Div. of Duro Metal Products Co. has been announced.

Mack Trucks, Inc., has announced the appointment of **George J. Hubert** as manager of the newly created contract termination dept.

The Bunting Brass & Bronze Co. has announced the appointment of **Robert R. Hirsch** as director of sales, succeeding **George H. Adams,** recently named executive vice-president of the company.

Roswell H. Rausch, president of the Automatic Paper Machinery Co. of Hoboken, has been elected to the Board of Directors of the Fairchild Engine and Airplane Corp.

Col. Donald C. Swatland, AC, has been named chief of the procurement div. of the AAF Materiel Command. He succeeds Brig. General Aaron E. Jones, of Cincinnati.

Aircooled Motors Corp. has announced the appointment of **Harry T. Parsons** as administrative assistant to C. F. B. Roth, vice-president in charge of sales.

The following appointments in the recently created chemical division of **The B. F. Goodrich Co.** have been announced. **William I. Burt,** general manager of plants; **Dr. Frank K. Schienfeld,** director, technical and development; **Dr. Victor E. Wellman,** director of purchases, and **Harry E. Foster,** general auditor.

Evans Products Co. has announced the appointment of **Ferdinand A. Keihn** as manager of the Evans Auto-Railer Div., succeeding **Charles Gross,** resigned.

B. M. Staley has been appointed factory manager of Kaydon Engineering Corp.

The J. G. Brill Co. has announced the election of **Howard A. Flogaus** as vice-president in charge of engineering for the company.

The promotion of **Harold W. Reilly** to assistant treasurer of the Ranger Aircraft Engines div. of the Fairchild Engine and Airplane Corp. has been announced.

Paul W. Polk, vice-president of the Sheffield Corp., has been granted a leave of absence to accept a commission at lieutenant (jg) in the United States Navy.

Major General Follett Bradley, U. S. Army, retired, formerly in command of the First Air Force at Mitchell Field, N. Y., has been named assistant to the president of the Sperry Gyroscope Co.

Henry Ford II, grandson of Henry Ford, has been elected a vice-president of Ford Motor Co. He will devote most of his time to the distribution and sales dept.

George Russell, a member of the treasury division staff, has been appointed assistant treasurer of General Motors Corp., with headquarters in New York. **Roy E. Hammond,** a member of the comptroller's staff, has been appointed assistant comptroller, with headquarters in Detroit.

Courtney Johnson, former Washington representative, has been named assistant to the board chairman of Studebaker Corp., dividing his time between Washington and South Bend, Ind. He also is chairman of the Materials Control Committee of ACWP.

Thomas A. Knowles has been elected a vice-president of Goodyear Aircraft Corp. He has been with Goodyear since 1927.

Edward L. Love, vice-president of the Chase National Bank, New York, has been elected a director of Willys-Overland Motors, Inc.

Kempton Dunn, treasurer of American Brake Shoe Co., has been elected treasurer of National Bearing Metals Corp., St. Louis. He will continue to be located in the former company offices in New York.

Oscar W. Nelson, general manager of the Curtiss-Wright Corp. Propeller Division plant at Beaver, Pa., has been named manager of division planning for propeller production.

Harry M. Ramsay has returned to his former position as assistant sales manager of the Fisk Tire Division of U. S. Rubber Co. after two years as manager of the fuel cell dept. at Detroit.

Willard F. Rockwell, board chairman of

ASK for a copy of the Campbell Abrasive Cutting Chart. It shows how the Campbell complete line of Abrasive Cutting Machines can be used to open the way to new highs of production and new lows of cutting costs.

CAMPBELL ABRASIVE CUTTING MACHINES HELP MEET LABOR SHORTAGE . . .

According to WPB, the peak of the skilled labor problem has yet to come.

If you cut any of the annealed or unannealed steels, non-ferrous alloys, plastics, glass or ceramics—solid bar, tubular or flat stock—a Campbell Abrasive Cutting Machine will help you.

Tell the Campbell Engineering Department materials, shapes, sizes, lengths before cutting, lengths of cut off pieces and hourly production required. They'll give you data without obligation.

Campbell

ABRASIVE CUTTING MACHINES

ANDREW C. CAMPBELL DIVISION · Bridgeport, Connecticut

ALSO MAKERS OF A COMPLETE LINE OF NIBBLING MACHINES

AMERICAN CHAIN & CABLE COMPANY, Inc.

BRIDGEPORT • CONNECTICUT

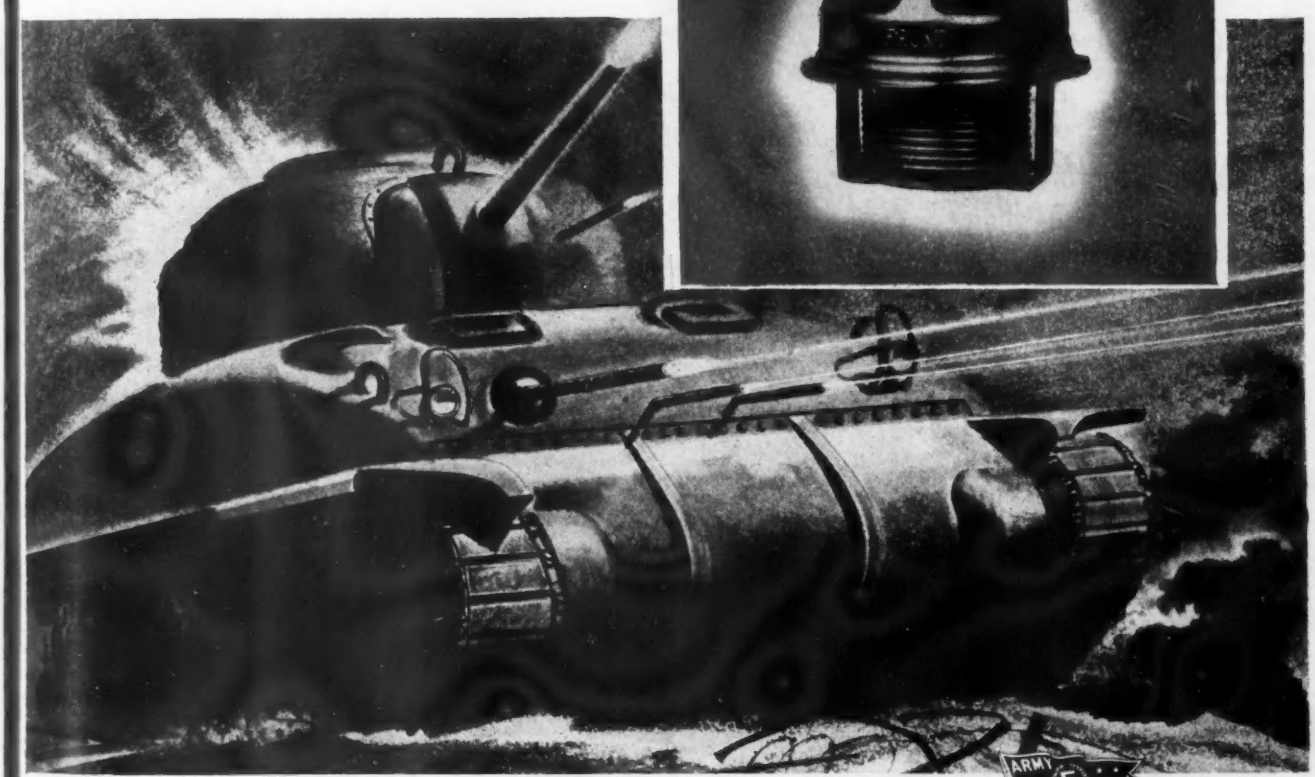
IT THINKS FOR THE DRIVER

AN essential part of the powerful engine that drives this tank is a Fulton Sylphon Thermostat which automatically controls circulation of the engine's cooling liquid to assure highest operating efficiency of the motor under all battle conditions. One thing less to think about for the busy driver and crew!

Because of their simple rugged construction, and positive operation, Fulton Sylphon controlling devices of many kinds are serving on fighting fronts and in war plants wherever temperatures and pressures must be regulated exactly and unfailingly.

Why not let the manufacturer of these widely accepted controls produce your bellows assemblies or complete instruments incorporating bellows? Fulton Sylphon facilities offer definite economies and assure unquestionable performance. Bulletin CB-535 describes many types of Fulton Sylphon Bellows and assemblies. Ask for help now on your post-war designing.

One of many types of Fulton Sylphon Thermostats for accurately controlling operating temperatures of liquid-cooled engines.



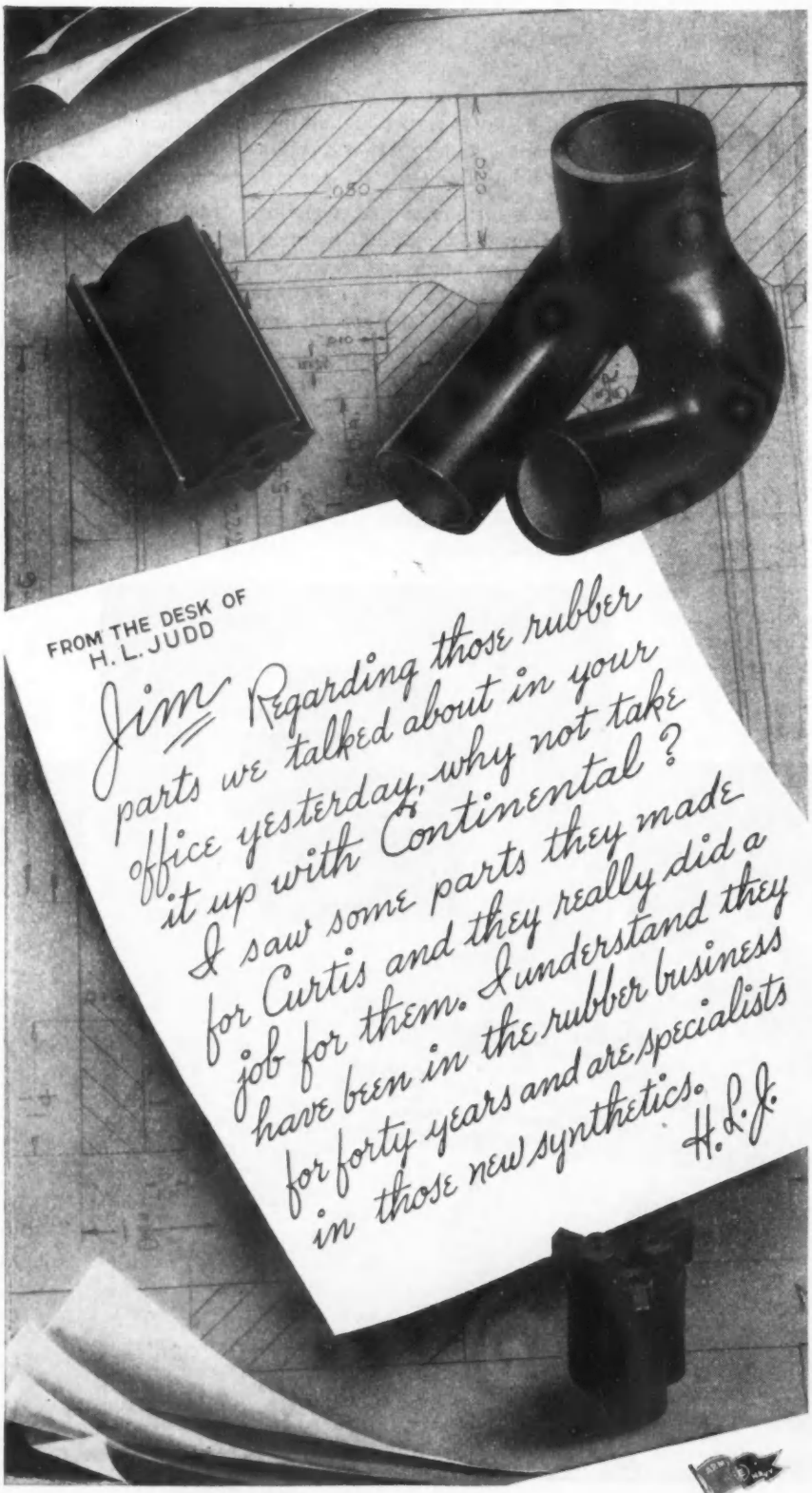
TEMPERATURE CONTROLS . . .

FULTON SYLPHON

BELLOWS . . . BELLOWS ASSEMBLIES SINCE 1904

THE FULTON SYLPHON CO., KNOXVILLE 4, TENNESSEE

Canadian Representatives, Darling Bros., Montreal, Canada


FROM THE DESK OF
H. L. JUDD
Jim Regarding those rubber parts we talked about in your office yesterday, why not take it up with Continental? I saw some parts they made for Curtis and they really did a job for them. I understand they have been in the rubber business for forty years and are specialists in those new synthetics.
H. L. J.

THE HAND OF THE SPECIALIST

CONTINENTAL RUBBER WORKS

ERIE, PENNSYLVANIA, U. S. A.

BRANCHES

Baltimore, Md.	Cleveland, Ohio	Kansas City, Mo.	Philadelphia, Pa.
Boston, Mass.	Dallas, Texas	Los Angeles, Cal.	Pittsburgh, Pa.
Buffalo, N. Y.	Dayton, Ohio	Memphis, Tenn.	Rochester, N. Y.
Chicago, Ill.	Detroit, Mich.	Milwaukee, Wis.	San Francisco, Cal.
Cincinnati, Ohio	Indianapolis, Ind.	New York, N. Y.	St. Louis, Mo.

Timken-Detroit Axle Co. has resigned as director of production for the U. S. Maritime Commission.

F. H. Smith has been appointed flight operations superintendent of the research laboratories of Sperry Gyroscope Co., Inc., succeeding **G. E. Bevins,** who becomes liaison supervisor of the research laboratories. **John B. Wilson,** formerly director of budgets and statistics, has been appointed assistant treasurer. **Frank F. Gilmore,** formerly organizational planning engineer, has been named assistant to the vice president for manufacturing.

UAW-CIO Reveals Plans For Industry-Wide Wage Agreements

(*Continued from page* 48)

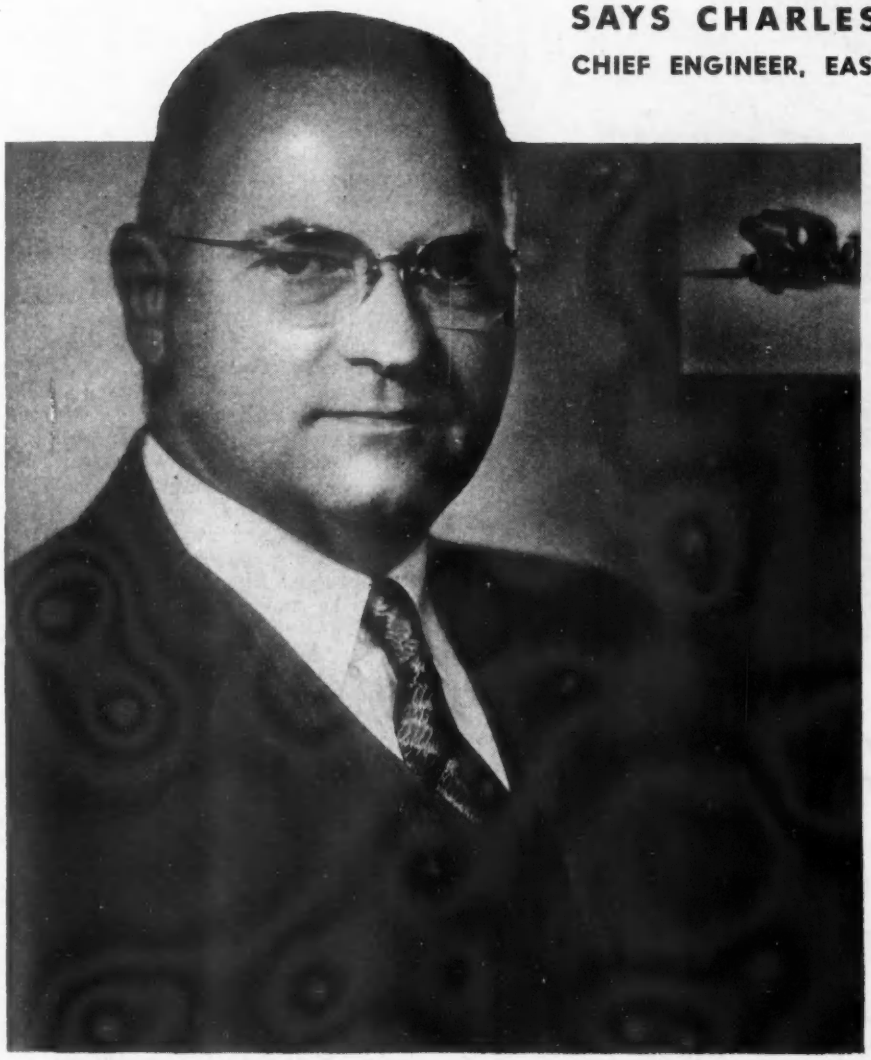
craft engine parts. The company refused to hear the grievance when the UAW-CIO jammed the conference room with union committeemen in addition to the specified three-man grievance committee. Six hundred and seventy-five technical employes affiliated with the Fraternity of Laboratory Workers, an independent union, engaged in a 16-day strike and picketed several Ford plants in a controversy over union recognition. The union won an NLRB election at the company last June but the company said that under its closed ship contract with the UAW-CIO it cannot recognize any unaffiliated union as bargaining agent for Ford employes. Among employe demands were retroactive pay for their 30-minute lunch period. The men finally returned to work at the request of the Detroit Regional WLB. A dispute over a petition to the WLB for a 5-cent hourly increase in the center wing assembly dept. at the Willow Run bomber plant resulted in a four-hour sitdown by 925 workers. Thirty-eight employes of the Ford rolling mill quit their jobs in protest over being cut 15-minutes' pay for leaving their work early and a sympathy strike sent 1,000 workers home.

Eleven hundred foremen at eight Detroit area plants of Chrysler Corp. voted to end an eight-day strike after the National WLB requested them to go back to work. The men, members of the Foremen's Association of America, an independent union, were seeking collective bargaining certification, which has been blocked by an NLRB decision of last May. The Chrysler case, along with that of several other companies, is awaiting decision from the WLB.

Several employes of the Norge Machine Products Division of Borg-Warner Corp. at Muskegon were reclassified in 1-A by draft boards after 41 employes were fired by the company for engaging in a 12-day strike over the rehiring of a former union steward. I. E. Washburn, international president of the UAW-AFL, walked out on a Detroit Regional WLB panel hearing on the case when the panel chairman refused to withdraw a company request

"A Single Pound Saved on a Plane... is Worth Over $80.00"

SAYS CHARLES FROESCH,
CHIEF ENGINEER, EASTERN AIR LINES



"The great importance of weight reduction in airplane manufacture cannot be overemphasized. In the case of military craft, reduced weight is, of course, translated in terms of increased firepower, range, armor, speed; its measurement in dollars-and-cents value is impossible. But when *commercial* planes are considered, the saving of even one ounce is reflected in a plane's enhanced productivity from a financial point of view. On Eastern Air Lines, for instance, one pound of payload is worth, conservatively, over $80 of revenue during the first 5 years of the life of a plane."

SEND FOR BOOTS WEIGHT-SAVING BOOKLET TODAY

A comprehensive study of the comparative weights of different types of self-locking nuts. For the convenience of aircraft designers, engineers, operating and maintenance personnel.

BOOTS NUTS SAVE UP TO 60 LBS. PER PLANE

- Now used on all types of military aircraft, fighters, bombers, cargo planes.
- After the war, will be used on commercial planes, also.
- Are lighter, yet tougher than other nuts.
- Have increased load capacity of U. S. military planes *by over one-and-a-half million pounds.*
- Have greater re-usability.
- "Outlast the plane."

BOOTS SELF-LOCKING NUTS
"There's No Excuse for a Nut Shaking Loose"

Boots Aircraft Nut Corporation, General Offices, New Canaan, Conn., Dept. H.

Millionths of an inch accuracy in these Vital Aircraft Parts is achieved by Western Automatic on a quantity basis

● It's no job for amateurs, making these Lycoming R-680 aircraft engine cam followers and cam follower guides of alloy steel. Clearance between walls of follower and guide must be held between .0013 and .0003 inch—and the mating diameters are ground and honed to a 10 micro-inch finish, a mere 10 millionths of an inch! *And they've got to be interchangeable—they're not* factory paired. It pays you to know about Western Automatic's production ingenuity, skilled workmen and vast precision equipment that turn out work like this on a quantity basis for war—and that can do it for your post-war needs after Victory. We may not be able to help you now, but we suggest that you write us for complete facts *now*.

Aircraft Products Division

Western Automatic

Machine Screw Company

Elyria, Ohio, U. S. A.

Precision Parts and Assemblies Since 1873

for a new study of certain jobs preparatory to a revision of wage rates. Washburn said he did not propose to see the union "framed" nor that it should be required to give up its war gains. The panel hearing continued without union representation.

25,000 members of The Mechanics Educational Society of America staged a 4-day walkout in 44 war plants in Cleveland, Toledo and Detroit in a protest move against the Government's alleged discrimination in favor of the CIO and AFL in disputes with independent unions. The strike followed a jurisdictional dispute at Willys-Overland Motors, Inc., in Toledo where MESA officials refused to attend an NLRB hearing after the UAW-CIO petitioned for a vote among 900 tool room employes now represented by the MESA. The 8000 production workers at Willys-Overland have a closed shop contract with the UAW-CIO.

Mathew Smith, belligerent secretary, and George White, president of the MESA, called the strike against "raiding tactics" and "muscling in" by the UAW-CIO at Willys-Overland and charged the administration with favoritism towards the CIO.

"Our union does not have a single representative on any of the Government agencies such as the WLB or WMC," said Smith. "Whenever one of our wage cases comes before a WLB panel, none of the CIO members ever votes to give any of our members as much as a 2 cent raise." The national WLB ordered the MESA to terminate the strike and served subpenas upon Smith and White to appear before that body in Washington. The subpenas were temporarily ignored by Smith and White, who instead attended a meeting of the 110-man MESA executive board in Cleveland. The board ordered subpension of the strike pending hearings before the national WLB. Ralph A. Bard, acting secretary of the Navy, also demanded that the strikers return to work immediately and termed the walkout without provocation.

Plants affected by the strike included Cleveland Graphite Bronze Co., National Acme Co., and Eaton Mfg. Co., in Cleveland, Electric Auto Lite Co. and Willys-Overland in Toledo, Nash Kelvinator Corp., Michigan Tool Co., and Parker Wolverine Co., in Detroit, as well as some smaller companies and a number of tool and die shops. The MESA, an independent union formed in 1933 claims 52,000 members in 67 plants in Michigan and Ohio, mostly skilled workers in the tool and die and maintenance classifications. The union never has subscribed to the wartime no strike pledge given the Government by the AFL and CIO. The MESA was involved in another jurisdictional dispute with the UAW-CIO in November, 1942, when it staged a one-day walkout in 16 Detroit plants in protest over the ejection of 8 of its members from the Briggs Mfg. Co. Aircraft plant. Smith briefly defied the WLB at that time.

Official U. S. Navy Photographs

THE "Water Buffalo" AND N-A-X HIGH TENSILE

N-A-X HIGH TENSILE is extensively used in the construction of the new LVT (2)—Landing Vehicle Tracked—to *reduce weight* and *still provide the strength and stamina* that equipment of this kind must have to meet the critical test of modern amphibious warfare.

Known as the "Water Buffalo," the LVT (2), designed, engineered and manufactured by Food Machinery Corporation, is a rugged amphibious vehicle which is highly maneuverable—on land, in swamps, and in the water.

At Tarawa, and more recently in the New Britain landings, amphibious vehicles such as these proved invaluable in surmounting obstacles in the water and gaining objectives ashore.

Great numbers of LVT's will be needed to carry out operations in all theaters of war—and large tonnages of N-A-X HIGH TENSILE will be needed to help build this equipment, but when the Victory is won, this outstanding steel will be used to build modern light-weight transportation equipment, as well as countless other products in which weight-reduction and strength will be important.

Buy Bonds and Help Speed Victory:

GREAT LAKES STEEL CORPORATION

DETROIT, MICHIGAN

Sales Offices in Principal Cities

Division of **NATIONAL STEEL CORPORATION** *Executive Offices, Pittsburgh, Pa.*

DUCTILITY
ITS INHERENTLY FINER GRAIN MAKES ALL THE DIFFERENCE
STRENGTH

Quantity Production of Gyro-Compass

(*Continued from page* 21)

To illustrate some of the machine shop operations, we have selected a few of the major parts for brief comment. First of these is the gyro element consisting of a drop-forged manganese bronze rotor wheel, weighing 56¾ pounds rough, 35½ pounds when finished. Most of the metal removal is done with cemented-carbide tools. The bulk of machining is handled on turret lathes while finish-grinding of the taper bore is done on an internal grinder.

The rotor shaft, made of heat-treated alloy steel, is processed as follows:

Cut off to length—Racine saw.
Straddle mill to length — horizontal mill.
Center drill both ends — double-end centering machine.
Turn and form—automatic lathe.
Rough and semi-finish turn various diameters and finish turn — automatic lathe.
Finish turn small diameters and form taper groove—lathes.
Heat treat.
Sand blast.
Straighten.
Grind diameters—10x18 grinder.
Cut oil grooves—thread miller.
Cut threads—thread miller.
Magnaflux testing.
Grind small diameters—10x18 grinder.
Lap grind and finish grind taper—10x18 grinder.
Wash and inspect.

The sensitive element, comprising the rotor, case and vertical ring assembly, is suspended in the phantom ring and stem assembly by means of the wire suspension assembly, and it is held in vertical alignment by means of two guide ball bearings. The phantom ring is an extremely delicate aluminum casting, requiring great care in machining to prevent distortion. In preparation for machining it is straightened and stress-relieved. Initial operation is that of milling pads on the East and West sides, holding one group of dimensions to plus or minus 0.005 in., the other to plus or minus 0.001 in. These operations are handled on high speed profilers. Other pads are rough milled on horizontal mills, holding dimensions to plus or minus 0.005 in. A large variety of holes are drilled, reamed, counterbored, back-faced, etc., using a special four-position vertical indexing fixture.

Another group of small holes is drilled in bench type drills in preparation for tapping. The previously rough-milled pads now are finish-milled, the castings stored for inspection, stress-relieved, inspected for warpage. Then follow a group of finish-milling operations and precision-boring of the bores in double-end precision boring machines, using cemented-carbide fly-cutters.

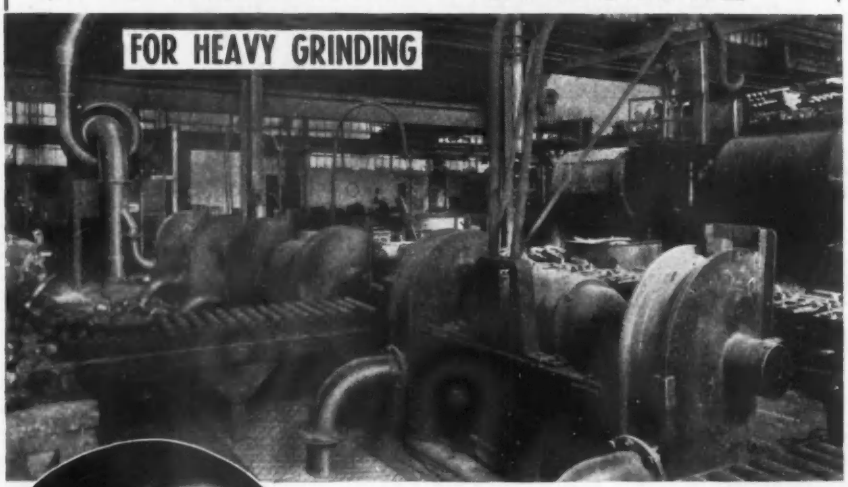
Holes are tapped in radial drills, using a special fixture. This is followed by precision boring in a double-end machine. Following these operations, the ring is final-inspected.

Another example of an extremely delicate aluminum casting is the mercury ballistic frame. As received, the casting is inspected, straightened, stress-relieved, then checked for warpage and straightened is necessary. The bottom surfaces of four bosses are milled for locating in succeeding operations. Sides of bosses are milled, care being taken not to spring the casting while clamping in the fixture. Four large holes are rough drilled in a radial drill press, then the casting is stress-relieved for finishing operations.

Pads are finish-milled, and various holes semi- and finish-reamed and other small holes drilled and spot-faced in the radial drill press. This is followed by detail drilling operations in another drill press. The link support arms are straightened and slots are rough- and finish-milled in the prongs. A number of holes now are hand reamed and hand tapped, using a special fixture to assure perfection of alignment. The part is washed, straightened if necessary and final-inspected.

It will be noted from this sketchy review that some of the major parts, made from aluminum castings, are quite delicate and subject to warpage

EVERY GRINDING DUST PROBLEM IS SOLVED BY ROTO-CLONE



ROTO-CLONE combined exhauster and dust separator offers exclusive advantages in the collection of all process dusts which are universally recognized. There is a size for every requirement—from single grinding wheel to any number or combination of dust sources. Complete engineering data is given in a group of bulletins describing in detail ROTO-CLONE'S operation and applications. Send for them without obligation.

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with PENNSALT CLEANER K-7

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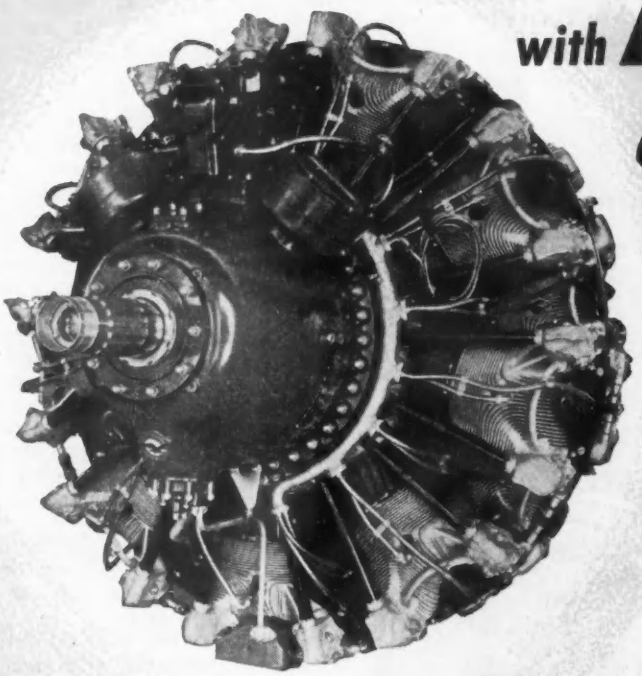

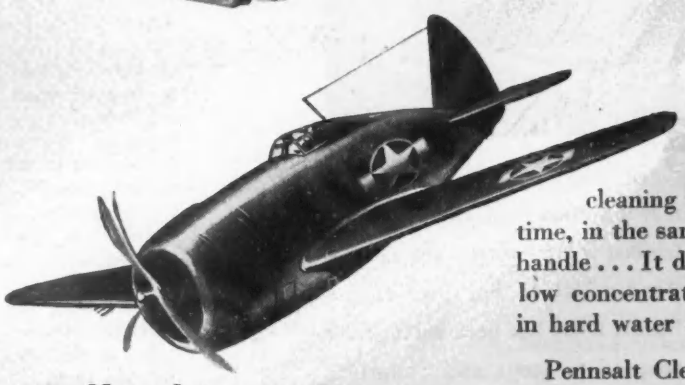

in the Bullard-Dunn Process

An important metal cleaning job in this plant is the removal of scale and oil from Pratt & Whitney aircraft engine parts. Pennsalt Cleaner K-7 was demonstrated in the Bullard-Dunn Process with highly satisfactory results, at a concentration of only 10 ounces per gallon.

Here are the outstanding advantages of this Pennsalt Cleaner: It does *not* leave a film . . . Both cleaning and defilming are done in minimum time, in the same tank . . . Pennsalt K-7 is easy to handle . . . It does not fume . . . It can be used at low concentrations . . . And it is suitable for use in hard water areas.

Pennsalt Cleaner K-7 was designed specifically for the cleaning and defilming operations in the Bullard-Dunn Process and has been thoroughly tested and approved by The Bullard Company.

Pennsalt Cleaner K-7 is one of a complete line of Pennsalt Cleaners available for all types of metal cleaning. If you have a wartime metal cleaning job, by all means make use of the wide experience of our technicians. No obligation. Simply write fully about your problem to our Pennsalt Cleaner Division, Dept. AA.

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and mis-alignment unless great care is exercised during the various stages of machining. To assure perfection, the castings are thoroughly checked before machining and are stress-relieved and straightened after rough-machining. The secret of the kind of job produced by Dodge lies in the development of specialized fixtures of massive construction which assure positive alignment without causing distortion.

The north-seeking sensitive element, consisting of the rotor, case, and vertical ring assembly must be so perfectly balanced and so suspended as to turn freely without measurable friction. To effect this, it is guided centrally by means of fine ball bearings but its full load is carried by a flexible wire suspension consisting of 18 strands of fine wire 0.009 in. in diameter. When assembled, each strand is free from torque and must have the same tension when supporting a 70-lb. weight.

This suspension is built up from individual strands of fine music wire in a special fixture, following the standard procedure outlined below:

1. Cut music wire to required lengths of 18 in.
2. Carefully examine and clean fixture and make sure it is thoroughly free from dirt or wire broken ends.
3. Examine lower stem and cable support for burrs, rough and finish taper ream and polish lower stem bearing surfaces with crocus cloth. Assemble both parts into fixture and check with gage to make sure the specified distance between them is maintained.
4. Place fixture in position on bench fixture support with stem in top position.
5. Inspect a strand of wire by sight and feel for kinks, rust and rough ends.
6. Assemble one end of wire in hole leading to No. 1 clamp and lock in position securely by tightening screw.
7. Thread loose end of wire through the inverted stem and down through the support, which has been assembled in the lower section.
8. Attach a two-pound-weight to the lower end of wire, making sure by magnifying glass examination that the wire is properly set in the groove that leads from the clamp hole, and allow it to hang undisturbed until all torque in the wire has expended itself and the two-pound weight has settled to a dead stop.
9. Place wire in position for locking at the lower end of the fixture. Inspect with magnifying glass and view it from the top of the fixture through the hole to make sure that the wire is properly placed in position. Clamp securely with anchor block and clip off loose excess wire end.
10. Proceed with No. 2 to No. 18 wires inclusive, using same procedure as stated above for No. 1 wire.
11. When all 18 wires have been clamped in position, the assembly is washed with Varsol to remove all forms of dirt. Fixture is then inverted by tumbling and then placement of wires and correct assembly are checked with a magnifying glass. When checked and found O. K., wedges are assembled to securely fasten the wires in place.
12. Loosen wire clamping device and pull upper wire ends from guiding holes in fixtures. Snip lower ends of wire flush.
13. 225-lb. tension test.
14. Remove suspension assembly from fixture and snip off ends of wire.
15. Final test in fixture. Thoroughly cover the entire assembly with rust-proofing oil and seal in mailing tube ready for compass assembly.

The foregoing has touched on some of the features of the sensitive element of the gyro which is free to move with three degrees of movement. To make it truly north-seeking, the mechanism is provided with a "mercury ballistic" system, supported in the ballistic frame noted earlier. This frame carries two sets of cups containing mercury, one on the east side, one on the west, interconnected by a length of tubing. The frame is pivoted on the phantom ring

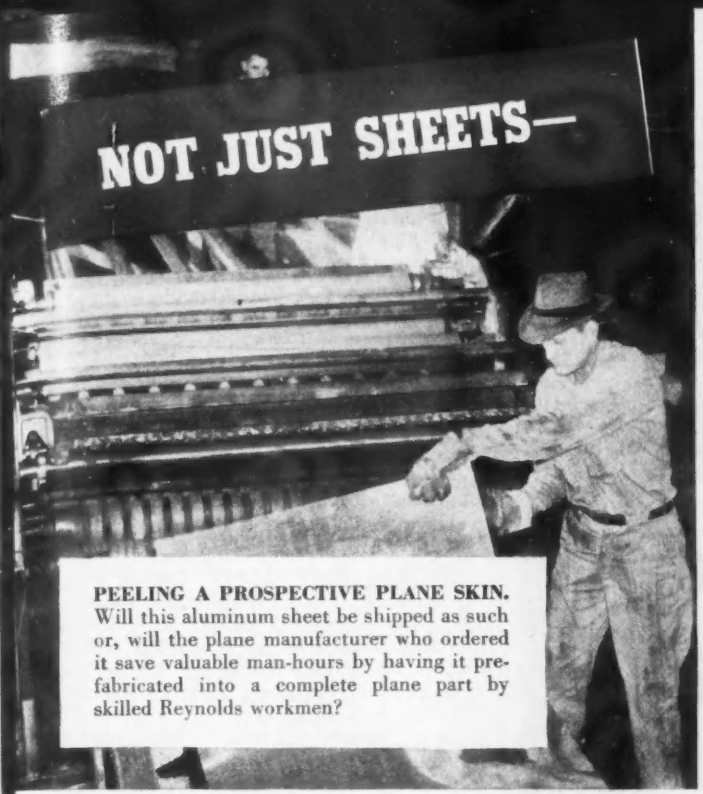
And count on the Bendix* Drive for action!

Many of the mechanical improvements engineered into today's jeeps will undoubtedly make their appearance in the cars of the future. But no matter how radical the coming engineering changes may be, there will always be one familiar *starting point* — the famous Bendix Drive. For just as the Bendix Drive has been successfully adapted to jeeps and countless other military vehicles of today, so it will be on hand to provide quick, sure starts for the revolutionary new automotive equipment of tomorrow.

The Bendix Drive is an important member of "The Invisible Crew"—precision equipment which more than 30 Bendix Plants from coast to coast are speeding to our fighting crews on world battle fronts.

THE INVISIBLE CREW — Precision Equipment by Bendix Aviation Corporation

*TRADE MARK OF BENDIX AVIATION CORPORATION

ECLIPSE MACHINE DIVISION

PEELING A PROSPECTIVE PLANE SKIN. Will this aluminum sheet be shipped as such or, will the plane manufacturer who ordered it save valuable man-hours by having it prefabricated into a complete plane part by skilled Reynolds workmen?

NO LOST TIME when you use Reynolds Prefabricated Plane Parts. Completely finished parts can go right on the assembly line as soon as they are received at your plant. This modern method, pioneered by Reynolds, saves you manpower, plant space, time and scrap.

. . . when you use REYNOLDS complete prefabricated Plane Parts Service

- *SAVES MANPOWER*
- *SAVES SPACE*
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- *SAVES SCRAP*

From our global battlefronts come the never-ending pleas, "Give us more planes, better planes". . ."deliver them faster." In the face of this, fabricating aluminum sheets into plane parts in your own plant takes manpower you can ill afford to spare.

By using Reynolds prefabricated plane parts service you can use all of your manpower to build planes.

- It saves you manpower because every aluminum piece you receive is a finished part, ready for immediate assembly.
- It saves plant space because you do not have to maintain excessive stock piles, do all your own fabricating or store and segregate your own scrap.
- It saves on transportation because it releases freight cars needed to haul scrap metal from your plant.
- And it saves on scrap because the 30% of every aluminum sheet that becomes scrap is refabricated in our plants in a matter of hours instead of months.

Reynolds finished parts saving thousands of man-hours

Airplane labor amounting to thousands of hours is being saved by Reynolds prefabricated plane parts. In fact, Reynolds, the first aluminum manufacturer to furnish complete plane parts from aluminum sheet, is supplying complete parts to every leading manufacturer of combat planes.

It is this trait of daring to lead, daring to be different, that has spurred on Reynolds, in 4 short years, to where its operations now cover 40 plants in 14 states, plus its own source of Bauxite from which aluminum is made. This urge to constantly move ahead is what keeps Reynolds men on a ceaseless search for new ways to make aluminum better . . . make it easier and cheaper to use.

Take advantage of Reynolds' resources, equipment and engineering skill. For any problem you may have in working with aluminum, no matter what it may be, you'll find Reynolds able to handle it in the most practical way. Reynolds Metals Company, Aluminum and Parts Divisions, Louisville, Kentucky.

REYNOLDS METAL

REYNOLDS ALUMINUM

on two ball bearings. The rotation of the earth from west to east causes an apparent tilting of the gyro rotating axis and mercury flows from one side or the other, producing an unbalanced condition of the mercury and a precession of the gyro to the north.

From this it can be seen that the function of the mercury ballistic system is of greatest significance and justifies the painstaking care that is taken to achieve precise alignment and maintenance of close tolerances in every part of the machined structure.

The latitude corrector assembly, providing the correction for changes in latitude and speed of the ship by automatically changing the positioning of the lubber ring, which carries what is known as the lubber line, is truly a precision instrument. Its final assembly is all done by hand to assure perfection of fit and alignment. The component parts are first machined to size, then finished by hand in various steps. Since no play or shake is permitted, although frictionless operation is desired, the threads on the lead screw are milled and ground, then hand-lapped if necessary to fit the adjustable block. To assure perfection of alignment of the setting knob and collar with the supporting block, the contact area of the block is spot-faced so as to obviate the need for squaring the entire surface.

Pin holes are first drilled with an undersized drill, then followed by drilling with a full-sized drill to avoid oversize. To leave the block surfaces free for grinding and lapping, the frame stud is pressed-in after the entire assembly has been completed and inspected. It is pressed-in on an arbor press, care being taken to assure parallelism. Generally speaking, all of the parts entering into the corrector assembly are meticulously hand-lapped and polished in matched sets.

Easily the most exacting of the operations in this plant is the assembly and balancing of the rotor and shaft assembly. The very heart of the gyro, the rotor assembly spins at the rate of 6000 rpm while at work and it must be as free from vibration as is humanly possible to achieve. Balancing is accomplished in several stages, using a specially designed dynamic balancing machine with a cathode ray oscillograph indicator screen.

For rough balance, the rotor is brought up to a speed of 1700 to 1800 rpm, the current is cut off, and readings taken while the rotor is spinning due to its own inertia. The number of holes and their depth are determined from the calibration chart while their angularity is taken from a protractor.

For final balance, the assembly is first subjected to a heat and stretch run of three hours, while assembled in the rotor case as it would be in the completed instrument. This run is made at a speed of 9000 rpm. Upon completion of the heat run, the unit is disassembled and the rotor assembly is ready for final balance. Here the rotor is spun at 5000 rpm while mounted on babbitt-lined journals which are held under constant oil pressure to assure proper lubrication.

The foregoing is intended to provide simply a sketchy review of some of the details of the manufacture of the gyrocompass, under mass-production techniques developed by Chrysler Corporation and employed for the first time in the history of such equipment. The pictorial section, featuring views in various corners of the plant, should enable the reader to visualize some of the major aspects of the operation at first hand.

Sperry Award to Bergen

William Benjamin Bergen, chief flight test engineer of The Glenn L. Martin Company, Baltimore, Md., has received The Lawrence Sperry Award for 1943.

This award is presented annually by the Institute of the Aeronautical Sciences for a notable contribution made by a young man to the advancement of aeronautics.

Mr. Bergen received the certificate of award and an honorarium of $250 at the Honors Night Dinner of the Institute at the Waldorf-Astoria for his experimental studies of dynamic loads on airplanes.

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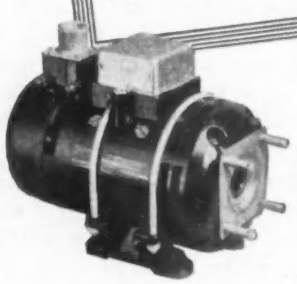

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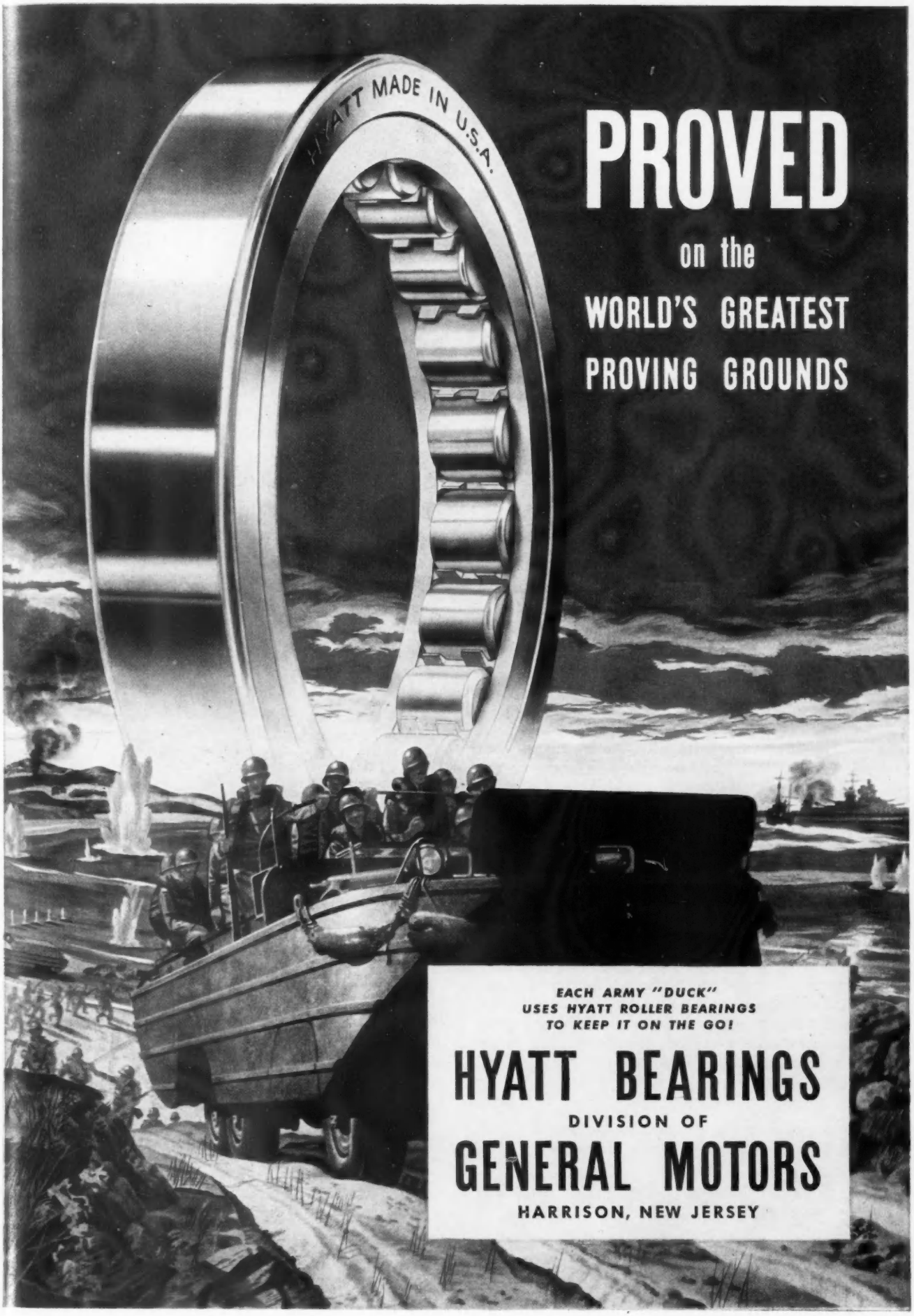
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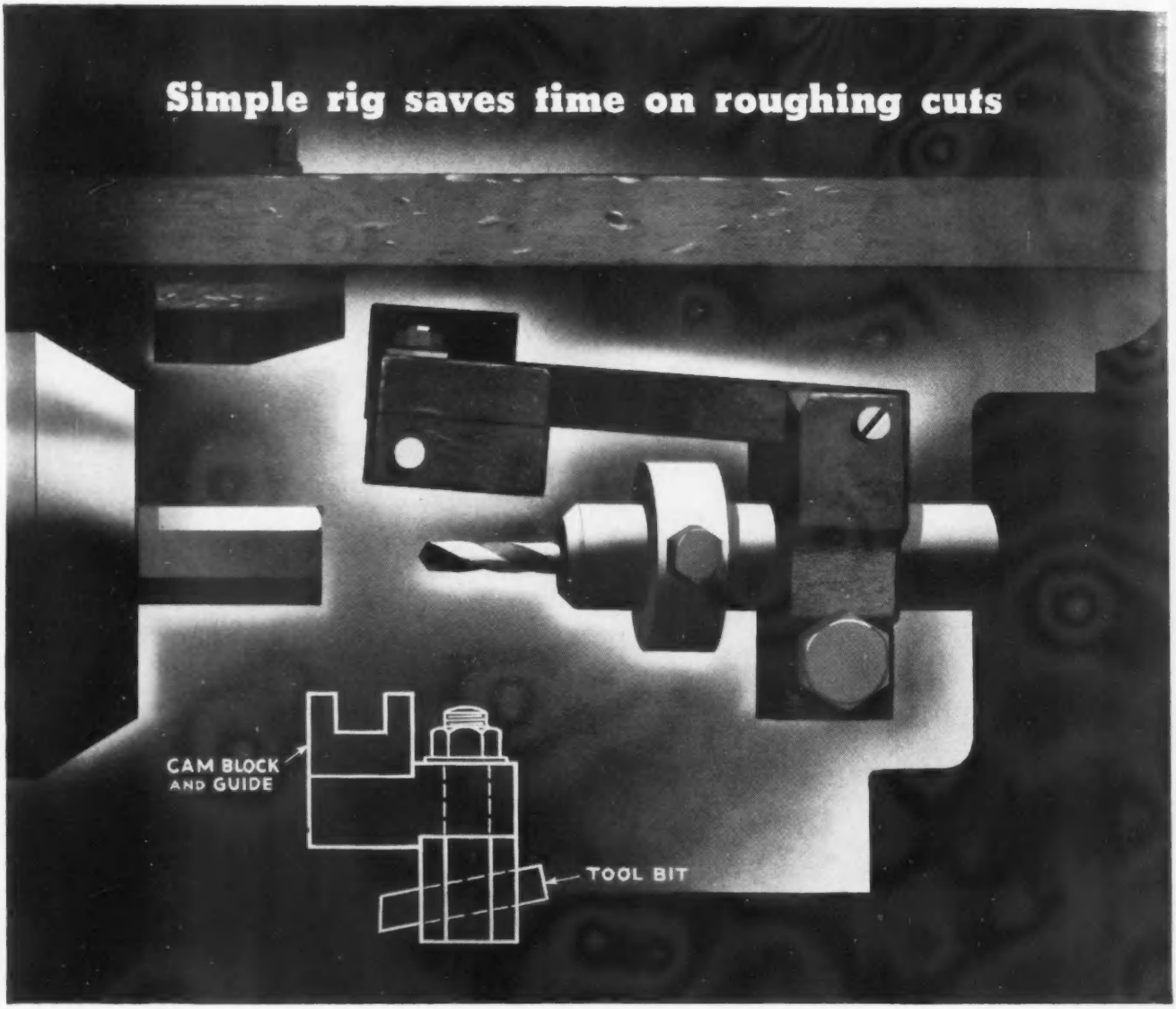
Simple rig saves time on roughing cuts



Information supplied by an Industrial Publication

Roughing tools conventionally mounted on turret lathes or hand screw machines have a tough time cutting hex bar stock. Intermittent cutting, accompanied by successive severe shocks make frequent resharpening necessary. This means equally frequent machine shutdowns.

The problem of eliminating the lost time on such jobs has been solved in a New England plant by an ingenious rig applied to some old turret lathes.

The rig consists essentially of two bars. One, carrying the roughing tool, is pivoted to the turret. The other, having a very simple adjustable cam on its lower side, is fastened between the top of the turret and a sliding support on the headstock.

As the turret advances the roughing tool, the cam feeds it downward, then guides it horizontally and supports it transversely while the roughing cut is made. A drill or other inside tool may be fed in to work simultaneously.

When the roughing cut is finished, the tool is backed off, and the finishing tool fed in on the cross slide. When the roughing tool needs resharpening, it is simply a matter of a few minutes to take it out of the holder and put a sharp tool in. Shutting down is unnecessary. There is less need for expert grinding and resetting.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.

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MOLY

New Products for Aircraft

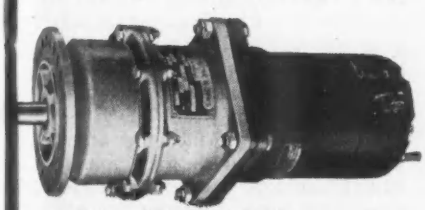
(*Continued from page 42*)

aviation jack. The gauge, scale beam, etc., are mounted on a mobile buggy where one observer checks weighing. The airplane is lifted on two wing jacks and tail jack to clear the ground. The pump on the mobile buggy is then operated with two or three strokes. The exact weight at each point is recorded on the scale beam. The total weight on the three scales denotes the total weight.

Multiple Gear Reduction Torque Shaft Actuator

A recent development of the Western Gear works, Pacific Gear Plant, Lynwood, California, is multiple gear reduction torque shaft aircraft actuator shown. The Pacific Model EL-1095 actuator is designed for extension and retraction of wing flaps, landing gears, landing gear doors, nose wheels and doors, bomb bay doors or similar applications.

The Pacific EL-1095 actuator weighs



Pacific Model EL-1095 actuator

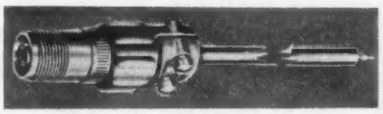
but 17 lbs, yet has an adjustable maximum slip torque capacity up to 600-in. lbs. Mounting flange has twenty-four 21/64-in. diameter holes spaced 15 deg. on a 4.000-in. bolt circle. It has an output speed of 110 rpm at 573-in. lbs. An externally adjustable slip clutch guards against overloads. A General Electric motor is used.

Fenwal Fire Detectors

Fenwal Incorporated, Ashland, Mass., announces a new continuous type and a new unit type fire detector for use throughout aircraft; primarily, engine and accessory sections. The continuous type is in the form of a fusible alloy tube, copper plated, containing inorganic insulating beads which support a conductor-wire. This, when mounted on an engine or throughout a plane, gives warning to the pilot for manual operation of fire extinguishing equipment.

Flame applied to the assembly causes the tin alloy to melt, filling the spaces between adjacent beads thereby completing the circuit between the conductor-wire and the grounded tube. The circuit thus completed is used to actuate either signal light or other alarms. A false alarm will not occur from an ordinary back-fire.

The unit type uses the principle of the Fenwal Thermoswitch in which the temperature detecting unit is based on



Fenwal continuous type Fire Detector with connector

the expanding shell which separates two silver contacts carried on curved invar struts under high spring tension. Contacts may be arranged to either open or close the circuit on temperature increase as required. The advantage of the unit type installation is that it will withstand repeated temperatures of 2,000 deg. F. without damage or change in the calibration point. It is frequently used in conjunction with the continuous type for isolated spots.

Eclipse Servo Control Systems

Eclipse-Pioneer Division, Bendix Aviation Corp., Teterboro, N. J., has brought out a series of aircraft servo motors for application where positive straight line or rotary motion with or against opposition is required. In con-

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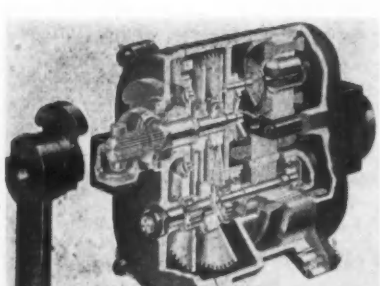

Eclipse servo motor

junction with autosyn transmitters and amplifiers, all inter-connected, control systems can be designed to specific applications to provide remote automatic and coordinated control of aircraft main engines, elevator, rudder, and aileron control surfaces. Accurate and positive remote adjustments of exacting flight functions is obtainable. Several motors have been designed to provide for straight line motion, rotary motion, and continuous rotary motion.

The use of Eclipse Aviation servo control systems provides a compact, lightweight, clean installation eliminating mechanical and hydraulic linkage with no complicated switching special relays, potentiometers or motor brushes. In addition, current consumption is comparatively negligible.

Forss Slow Hitting Riveting Hammers

The Forss Pneumatic Tool Company Rockford, Ill., is introducing a new line of slow hitting aircraft riveting hammers, of which two popular sizes are already in production. The smaller size, designated as HA-19 has a

Forss riveting hammers

nominal capacity of ⅛-in.-5/32-in. rivets and the larger size, designated HA-39 has a nominal capacity of ¼-in. rivets. The HA-19 with offset handle is 5/16-in. long overall, including the beehive retainer, and has a weight of 2 lbs. 5 oz.; with the grip handle it is 7-⅞-in. long and weighs 2 lbs. 7 oz. The HA-39 with offset handle is 8-in. long and weighs 2 lbs. 14 oz.; with grip handle it is 10-9/16-in. long, weighing 3 lbs. Each Forss hammer includes as standard equipment the conventional beehive retainer and an adjustable air regulator. The nozzle takes standard Parker taper shank rivet sets 1-⅝-in. long and .401-in. diameter.

DPC Contract Increases

Chrysler Corp. has received an increase in a Defense Plant Corp. contract for $2,000,000 to provide additional facilities at a Detroit plant, bringing the total commitment to $4,450,000. General Motors Corp. has been awarded a contract boost of $275,000 for additional equipment at plants in Trenton, N. J., Tarrytown, N. Y. and Baltimore. Ford Motor Co. has been granted a $125,000 increase for added plant facilities at Iron Mountain, Mich. Willys-Overland Motors, Inc. has had its DPC contract raised $150,000 for additional equipment at Toledo. Packard Motor Car Co. has been the recipient of a $120,000 increase for equipment at a Detroit plant.

American Bosch Corp., Springfield, Mass., has signed a contract for $1,350,000 covering new plant facilities at Chicopee, Mass. Bowler Roller Bearing Co. has received an increase of $150,000 for more equipment at a plant in Detroit, raising the total commitment to $1,350,000. Woodall Industries, Inc., has been allotted $170,000 for additional facilities at plants in Detroit and Monroe, Mich.

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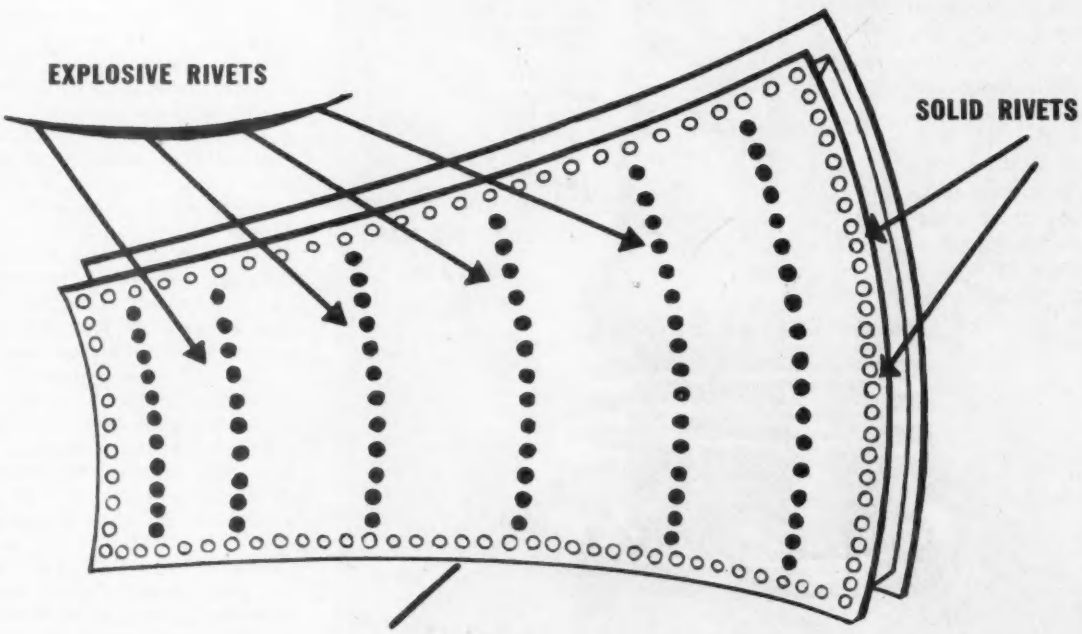
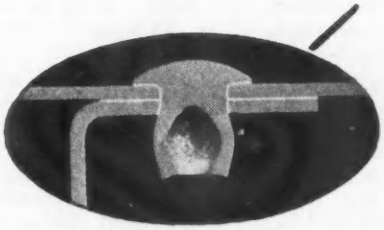
VOLUME TIGHTI

APPLYING THE INNER SKIN OF A NACELLE DOOR ... IN A HURRY



Another typical job for Explosive Rivets

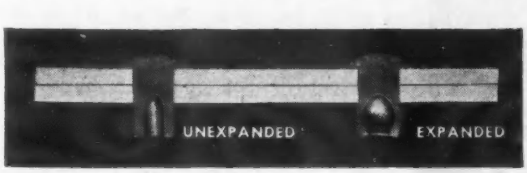


NO LONGER is blind riveting a production line bottleneck. Today, inner skins of landing gear and bomb-bay doors and similar blind riveting jobs are done in a jiffy . . . thanks to Du Pont Explosive Rivets.

These rivets simplify blind riveting operations. One riveter can readily set from 10 to 20 Explosive Rivets a minute.

The rivets are inserted in drilled holes. The tip of an electrically heated Du Pont Riveting Iron is then applied to the rivet head. This fires a tiny charge concealed in the shank of the rivet, forming a strong, one-piece blind head that firmly sets the rivet in place. No further operations are required to complete the job.

Here's blind riveting at high speed... an easy way to do a tough job quickly. Consider Du Pont Explosive Rivets. They're saving time and costs on many production lines and in repair shops. Write for folder: "How to use Explosive Rivets." E. I. du Pont de Nemours & Co. (Inc.), Explosives Dept., 5494 Nemours Building, Wilmington, Del.—5-238 General Motors Building, Detroit, Mich.—5801 South Broadway, Los Angeles, Calif.



DU PONT
REG. U. S. PAT. OFF.

EXPLOSIVE RIVETS

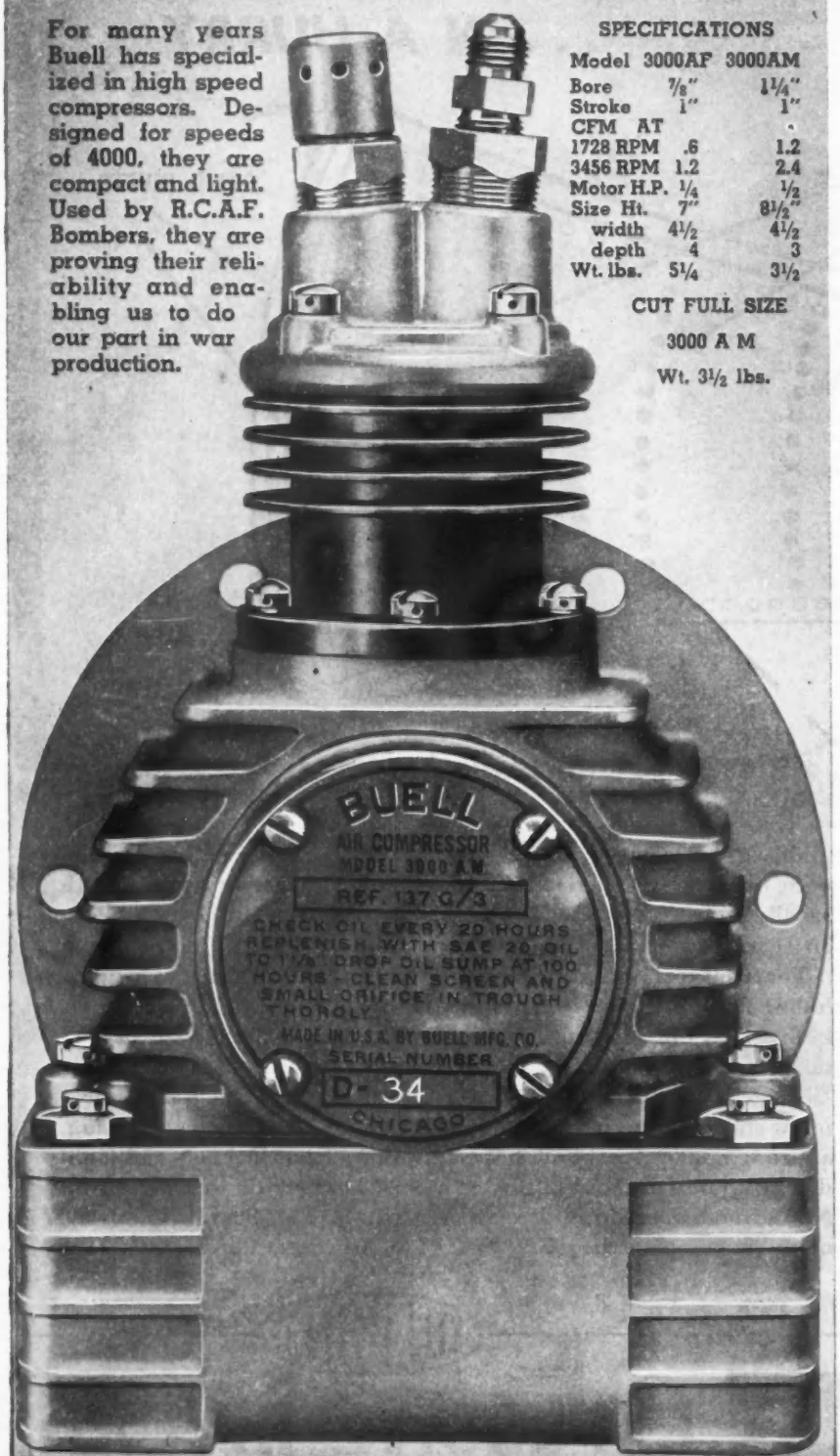
The one-piece blind fastener

TIGHTLY BOUND

BUELL . . . AIR COMPRESSOR

A precision built product with high alloy forged steel crankshaft, hardened and ground to close tolerances.

For many years Buell has specialized in high speed compressors. Designed for speeds of 4000, they are compact and light. Used by R.C.A.F. Bombers, they are proving their reliability and enabling us to do our part in war production.



SPECIFICATIONS

Model	3000AF	3000AM
Bore	7/8"	1 1/4"
Stroke	1"	1"
CFM AT		
1728 RPM	.6	1.2
3456 RPM	1.2	2.4
Motor H.P.	1/4	1/2
Size Ht.	7"	8 1/2"
width	4 1/2	4 1/2
depth	4	3
Wt. lbs.	5 1/4	3 1/2

CUT FULL SIZE

3000 A M

Wt. 3 1/2 lbs.

BUELL MANUFACTURING CO.
Dept. AA, 2975 COTTAGE GROVE AVE., CHICAGO, ILL.

Shifting War Conditions

(*Continued from page* 17)

tion of synthetic rubber is a problem at Government plants and tire manufacturers are confronted with production problems in making synthetic rubber treads.

The manpower situation is still acute in many areas and dealers still are losing mechanics and other employes to the draft. The armed forces will induct 1,500,000 men in the first six months of 1944, of whom 600,000 are to replace men who have been discharged from the service for wounds, disabilities, over age or other reasons. However, the 100,000 men who are being mustered out of service every month offer dealers a labor source, especially as many of these men have been given training in automotive or aircraft maintenance while in uniform. There also is some movement of mechanics out of war plants and back to their old jobs in repair shops, although the Government is trying to discourage this quitting of war jobs for fear of a detrimental effect on war production.

The replacement parts outlook is encouraging although increased military demand, especially in view of an anticipated European invasion, may alter this view during the months ahead. Production of parts for civilian replacement in 1943 increased 59 per cent over 1942. The increased availability of materials like copper, lead, tin, aluminum and steel has made possible the relaxation of WPB limitations on their use in certain items, such as intake and exhaust valves, engine bearings and solder. Limitations on the manufacture of replacement batteries also have been relaxed to allow production of an estimated 19,300,000 batteries in 1944.

The question of surplus war materials and their disposal by the Government in the postwar period is one that has worried automobile dealers as well as other retail trades. They foresee the day when war stocks of passenger cars, trucks, replacement parts, batteries, service equipment and accessories will be available for distribution by the Government and they fear the effects which such liquidation might have upon their own businesses of these stocks are allowed to fall into the hands of speculators. With this in mind the NADA is backing the Patman Bill, which was introduced in the House and recently was referred to the Banking and Currency Committee.

The Patman Bill names the RFC as the sale agency for the distribution of surplus postwar commodities. It provides for the creation of a central agency charged with the collecting of surplus material and keeping accurate inventories of goods on hand. Under the measure a central committee would be composed of the board chairman of the Defense Supplies Corp., the Secretaries of War, Navy and Treasury and three experienced businessmen.

Ammunition for today and tomorrow

"Fittings" the trade calls them. But the term tells only half the story—and the least exciting half, at that. For these carefully-made but inconsequential-looking gimmicks are vital to every mobile fighting unit whether it wages battle on land . . . on sea . . . or in the sky. They are, in fact—ammunition!

These assorted fittings have been produced by the millions-per-week for war purposes in the four plants of The Weatherhead Company. And with Victory and Peace, they will become the ammunition with which we shall be prepared to help you build the better world for which we are all fighting.

Look Ahead with

Weatherhead

THE WEATHERHEAD COMPANY, CLEVELAND, OHIO

Manufacturers of vital parts for the automotive, aviation, refrigeration and other key industries.

Plants: Cleveland, Columbia City, Ind., Los Angeles
Canada—St. Thomas, Ontario

FREE: *Write on company letterhead for "Seeds Of Industry"—a history of The Weatherhead Company, its many facilities and diversified products.*

Sales of Government-owned surplus goods would be handled under direction of the RFC in cooperation with advisory committees chosen from the retail groups whose products are involved. The bill would consolidate the disposal of surplus commodities with that of Government-built war plants under RFC.

The perennial and controversial subject of factory-dealer relations, which has been dormant for two years due to the more immediate importance of wartime rationing, service and other problems, is again a live topic as the sale of postwar cars begins to look a little less distant. It was given some attention by the more than 2200 dealers from every state in the union and Canada who attended the Detroit convention of NADA. The report of the NADA Postwar Planning Committee went into the subject at some length and three resolutions adopted by the convention reflected this report.

The first resolution called upon the Postwar Planning Committee to urge manufacturers to adopt as policy a scientific study of sales potential in each trading area, confining new dealers appointed therein to the number necessary to achieve the sales potential, and adoption of an adequate territorial infringement policy to compel the dealer, who makes a sale in another dealer's territory, to pay a satisfactory amount to that dealer. A second resolution stated that NADA will resist any reduction in discounts or bonuses until the economy of the country has been stabilized and until such time as it shall have been proved that such reductions are proportionate to the changes in profits accuring to other component parts of the industry. A third resolution called on all manufacturers, who thus far have not already done so, to state to their dealers their policies with respect to distribution policies after the war, particularly as these policies will affect those dealers who have stayed in business throughout the war.

Two ways are open to the dealers in endeavoring to correct any evils which they believe to exist in factory-dealer relations. They can seek improvement around the conference table with the manufacturers or they can seek redress through legislation. However, there are limitations to both methods, as is pointed out by the NADA Postwar Planning Committee. The report also recommends appeal to the Federal Trade Commission, which made a lengthy investigation of the motor vehicle industry in 1939, if dealers feel they are suffering from monopolies, illegal trade restrictions, unfair competition and unfair and deceptive practices.

In seeking relief from factory practices through state licensing laws, the committee warns that there has been a lot of confusion regarding such laws, as those favoring them are inclined to exaggerate the benefits and those opposing them often improperly discount their effect. The committee believes that drafting of a uniform state licensing bill would be premature and urges state associations to make a complete study of all the ramifications of dealer licensing laws before preparing any bill for enactment or for the alteration of present laws. The report points out that state licensing laws cannot be used for controlling the price of new cars or the allowances on used cars, nor can they be used for controlling the number of dealers, even on the basis of declaring a dealership in the public utility classification. However, some merit was found in municipal ordinances for the control of licenses to exclusive used car dealers, preventing out-of-town dealers from dumping surplus stocks in a local market through used car auctions. Finally, the committee recommended "that in the postwar period dealers work concertedly to have the Government retire from all regulation of the lawful conduct of automobile retailing."

Richard H. Grant, who retired Jan. 15 as a vice president of General Motors after 20 years directing the automobile sales of that corporation, gave the dealers the factory viewpoint

GRIZZLY

BRAKE LINING

New GRIZZLY plant at Paulding—most modern and efficient in the industry!

Want Better STOP-ability?

You can put to your service the invaluable experience of Grizzly's 27 years of "Stop" Engineering!

You can enlist the precision—and volume—output of the industry's most modern and efficient brake lining production facilities!

You can obtain for your product the long-lived STOP-ability of a brake lining engineered for your own special purpose and, manufactured under GRIZZLY'S rigid quality control, from the "mix" of raw materials through each succeeding step of aging, moulding, curing and machining to close tolerances.

You should investigate Grizzly Brake Lining—for production and service—to meet every brake lining requirement!

MANUFACTURERS: Discuss your brake lining problems—on the "line" or on the "boards"—with Grizzly Engineers. Address Engineering Department at Paulding, Ohio.

GRIZZLY MANUFACTURING COMPANY
PAULDING, OHIO
PLANTS AT PAULDING AND LOS ANGELES
Warehouse Stocks in Principal Cities

here's SPEED · PRODUCTION · EFFICIENCY tied up with ECONOMY

Hansen

PUSH-TITE Air Hose Couplings

Today it's war and your only competition is Time. Tomorrow—Peace and with it keen competition in products, price and production in the wide open consumer market. **Economical production** will be tomorrow's vital factor in the manufacturing of any product and that is where Hansen **PUSH-TITE** air hose couplings come in.

¶ They're easier and faster to operate, greater production with considerable savings in time and effort. Hansen couplings are leakproof which means not only trouble-free operation but a great savings in "air" alone, in many cases sufficient to more than pay for the actual cost of couplings. ¶ If it's air, oil or grease lines it's Hansen **PUSH-TITE** Couplings because of their outstanding performance and definite savings.

Send for Free Catalog, covering the complete Hansen industrial line.

AIR HOSE COUPLINGS • HOSE CLAMP SOCKETS • HOSE CLAMPS
AIR BLOW GUNS • HOSE CLAMP PLUGS • ENGINE CLEANERS
SANDBLAST CLEANERS • AIR-LIQUID SPRAY GUNS

HANSEN MFG. CO.
1786 EAST 27th STREET
CLEVELAND, OHIO

on some of the questions coming before the NADA convention.

"In connection with attempts by NADA or state associations to better their condition by getting onto the statute books legislation in their own selfish interests," said Grant, "if a successful attempt is made in this direction, it is to be expected that dealers handling all important lines of goods will make similar attempts. If distributors and dealers generally attempt to solve their business problems by legislation, and thereby raise the cost of distribution, dealers should bear in mind that there are many more customers than dealers. Consequently, if the customers are energized to retaliate against some of this legislation, then you may expect your proposed legislation to be followed up with other legislation that will be very detrimental to your interests. Therefore, I recommend that very careful consideration be given by dealers before they permit their associations to go into legislative drives. Let's handle our business problems as far as we can within our industry and not too selfishly."

On the subject of agitation over factory-dealer contracts or selling agreements, Grant said, "I am certain . . . that the question of making net profits . . . is not going to be solved by the contract or selling agreement and this, to me, is the most important thing of all. The trend of selling agreements over the past few year is favorable to dealers. I doubt the wisdom on the part of dealers in attempting to get the type of contract that their lawyers are referring to. It takes two parties to make a contract, and if the dealers seek a contract that gives them certain rights in legal form, they must expect the manufacturers to demand other rights in legal form, some of which the manufacturers have not insisted on in the past. The contract, of course, cannot be one-sided. My judgment is that it is better for the dealers to ride the present trend than to attempt to force a radical change . . . In the postwar period, the question of discounts will be handled on a basis which will insure that the selling forces in the automobile business will continue to make a satisfactory return on investment."

TRU-THREAD DIAMOND DRESSING TOOLS ARE ACCURATELY ENGINEERED TO YOUR JOB!

TRU-THREAD tools embody a radically new idea in the *manner* in which the diamond is used. This new idea employs the natural hardness of the uncut stone to achieve accuracy, speed, durability and economy that are truly remarkable.

TRU-THREAD tools cut faster and forms are obtained more quickly. They cut cleaner, leaving the grits sharp and the grain open, creating a free-cutting wheel that holds its form longer. Down-time is reduced, fewer dressings are needed and many more pieces are ground between dressings. Production boosts have gone as high as 500%—and grinding cost per piece has dropped as much as 75%.

There is a TRU-THREAD tool made to dress *any* form —straight line, radial or multiple and each with equal accuracy—the accuracy that is engineered into them in our plant.

These new tools are now being made and reserviced on a production basis, assuring you fast deliveries. Write, wire or phone.

★

For use on
EX-CELL-O
JONES & LAMSON
DALZEN
and other thread grinders

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For forming wheels that grind
WHITWORTH
BUTTRESS
ACME
U S S
and any special form groove or standard thread.

★

WHEEL TRUEING TOOL COMPANY
3200 W. Davison Ave. Detroit 6, Michigan

B-25C and D Bomber

(*Continued from page* 36)

tube heater, de-icer and anti-icer motors, tow target windlass and electrical control for the combustion type cabin heater.

Radio Equipment

The radio equipment consists of the following: the command set for plane-to-plane communication, medium range liaison set for airplane-to-ground messages; frequency meter; the radio compass receiver, used for direction finding in cross-country navigation; the marker beacon receiver, which operates in conjunction with the instrument landing system; and multi-place interphone lines to each crew station, together with dynamotors, mouth and throat microphones and connections. Below the rear section of the fuselage is the trailing antenna, and under the nose is a fixed antenna for the radio marker beacon. Top side are the radio compass loop, and fixed antennas for the command, liaison and identification sets and for the radio compass.

Pilot's Cockpit

The cockpit for pilot and co-pilot is equipped with controls for flight, engine, landing gear, wing flaps and cowl flaps, emergency bomb release, remote control for the command radio and a button for firing the fixed nose gun. Here also are controls for the recognition lights for signaling to shore stations and ships. The automatic pilot is installed for the center of the pilot's instrument panel. The flush-type cockpit enclosure has an emergency exit at the top, windshield and movable panels of laminated glass and fixed panels of non-inflammable transparent sheet. Ingress and egress are through the entrance hatch in the navigator's compartment.

a drop in time saves . . . TROUBLE!

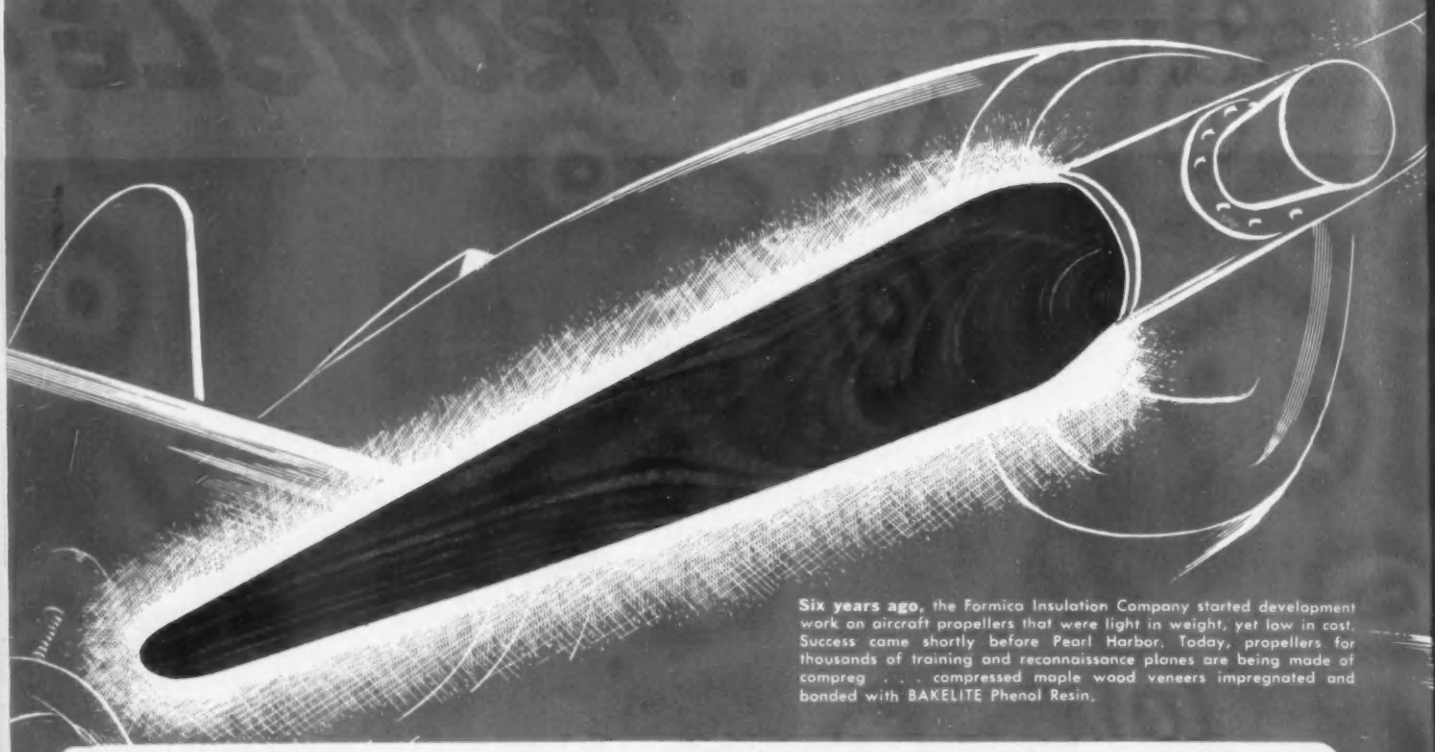
PUT SEVERAL DROPS OF OIL IN ALL OIL CUPS TWICE A WEEK!

A little oil at regular intervals is the best protection. A lot of oil, too late, won't save an injured part.

GISHOLT

★ *Reproductions of this page on enameled paper are available for bulletin-board use in your turret lathe department. Write the Gisholt Machine Company, 1205 East Washington Avenue, Madison, Wisconsin. Ask for the series of "Wartime Care and Operation Posters." State quantity desired.*

How can BAKELITE *Plastics*

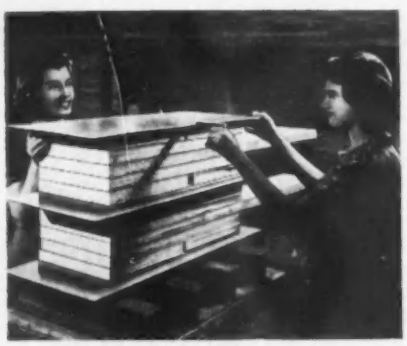


Six years ago, the Formica Insulation Company started development work on aircraft propellers that were light in weight, yet low in cost. Success came shortly before Pearl Harbor. Today, propellers for thousands of training and reconnaissance planes are being made of compreg . . . compressed maple wood veneers impregnated and bonded with BAKELITE Phenol Resin.

Choice maple veneers are placed in a cage, lowered into a vat of BAKELITE Phenol Resin. Vacuum, then pressure, assures complete saturation into the wood of this thermosetting resin. Later the veneers are removed and stacked to dry.

The impregnated veneers are then laid up and placed in a hydraulic hot-press. Here the heat softens the resin, the pressure compresses the wood to one-half its original thickness. Under continued heat, the resin sets. The result is a plank of compreg.

Here a worker is shown planing the densified wood block to assure perfect bonding in later operations. Measured in the grain direction these compreg planks can be said to have a weight-strength ratio of one-half the weight per volume of aluminum.



The planks of compreg are then coated with BAKELITE Phenol Resin and laid up to form the rough shape of the finished propeller blade. The metal plates dividing each unit are electrodes that will carry the high-frequency current used to bond the compreg planks to a single block of densified wood.

In the electrostatic press, high-frequency electrical current is passed through the entire propeller assembly, generating uniform heat throughout its entire depth. This is extremely important since only hot-setting resins can give the necessary bond, and since the tremendous thickness makes it impossible to use the steam platen or oven-heating processes.

After removal from the press, the blocks are rough-cut, then finished to form lightplane propeller blades. Although made of wood, these blades are water-resistant . . . have a tensile strength of 30,000 pounds per square inch, flexural strength of 40,000 pounds, and sheer strength of 8,000 pounds.

improve your products?

Can you produce them faster?... Can you improve them structurally, electrically, mechanically?... Can you build them at lower cost? The answer has been "Yes" for hundreds of products whose manufacturers have investigated BAKELITE Plastics.

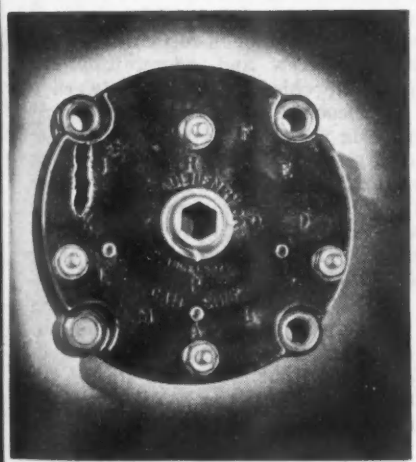
Complex shapes are being molded quicker... resulting in sturdy, finished parts at remarkably low cost. Coatings and finishes have been developed with BAKELITE Resin bases that are easier to apply, and that are far more durable and resistant. Wood has been given new strength and endurance... is now being fabricated in curved plywood sections up to 84 feet in length. Cloth laminated with BAKELITE Laminating Varnishes saves 45 per cent in weight of fighter plane ammunition boxes.

These and other examples illustrated on these pages are typical of the scores of applications and developments that you will keep posted on when you are in touch with Bakelite Plastics Headquarters. Our Engineering Staff and Development Laboratories can help you with essential problems. The literature illustrated below can help you with your present and postwar planning.

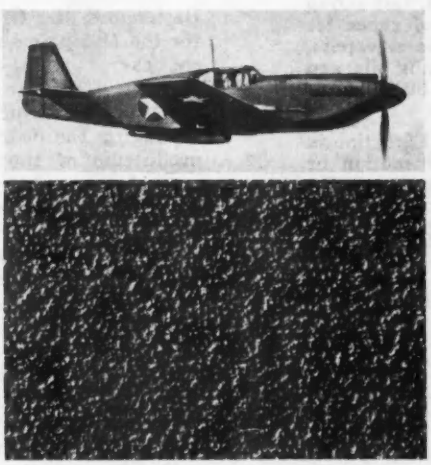
Write for specific technical literature today. Please address Dept. 27.

BAKELITE CORPORATION
Unit of Union Carbide & Carbon Corporation
UCC
30 EAST 42ND STREET, NEW YORK 17, N. Y.

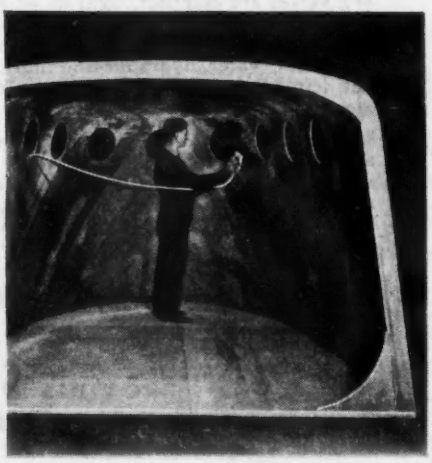
The preselector dial drum that automatically figures the gear ratios and speeds in the use of a No. 5 Warner & Swasey turret lathe was formerly made of metal. It is now molded of a BAKELITE *General Purpose* Phenolic Plastic eliminating several machining operations. The conversion has meant an important savings of metal and a reduction in production costs of approximately 80 percent.



After designing a new type rotary cam selector switch for sequence switching on airplanes, the Paul Henry Company found that simplified production and low cost demanded the use of a molded plastic. But which one? Experimentation pointed to a BAKELITE *Impact-Resistant* Phenolic. Further tests proved this material to have good electrical characteristics, high impact and tensile strengths, excellent heat and moisture resistance. Sales are up, production costs are down 20 percent...because this manufacturer investigated BAKELITE Plastics.



On the steps, catwalks, and cockpit floors of military aircraft, a covering that will withstand wear, yet be skid-proof, is absolutely essential. Rubber is slippery when wet. Other materials wouldn't stand the abuse. The Western States Lacquer Company developed an abrasive coating, particles of hard aggregate suspended in a rubber-like BAKELITE Plastic base. Sprayed or troweled on, this new coating gives a resilient, sandpaper-like surface to the flooring of some of America's leading bombing and fighter planes.



Deck houses for small boats are now being molded of plywood in a single piece. At the Haskelite Manufacturing Company's plant, veneers of wood coated with BAKELITE Resin Glue are laid in diagonal strips over a mold. Then low fluid pressure and controlled heat are applied which forces the plywood assembly to the exact contour of the mold and sets the glue. The finished deck house is 12 feet long, 9½ feet wide, and 8 feet high. It is light, strong, and durable.

USEFUL LITERATURE ON PLASTICS

"A Simplified Guide to Bakelite Plastics" gives a summary of the principal BAKELITE Plastics now available. It describes each type briefly, and illustrates typical applications. **"Bakelite Molding Plastics"** provides further information, and A.S.T.M. data on moldable plastics. **"Molding Technic for Bakelite and Vinylite Plastics"** is a 224-page manual on the art of molding plastics. It contains comprehensive data that the designer, engineer, molder, and user should have on the design and fabrication of hot-set and cold-set molding materials. Price $3.50 postpaid. Additional pamphlets and booklets describing other types of BAKELITE Plastics are also available. Write to Department 27 requesting these valuable guidebooks.

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TRADE MARKS
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PLASTICS HEADQUARTERS

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MEANS REMOTE CONTROL
"UP THERE"

In important airplane operations—such as propellor feathering, wing flap and landing gear, anti-icing and temperature control—*hi-g* electro-magnetic valves assure instant, positive response.

hi-g valves are compact, light in weight, fast-acting They are available in a wide range of types for handling aromatic or domestic gasolines or vapors, air, steam, water, hydraulic and lubricating oils, and anti-icing fluids under pressure up to 3000 lbs. or more.

Because they are vibration-resistant and function in any position, regardless of change of motion or acceleration, *hi-g* valves can be engine-mounted. On aircraft as well as trucks, tractors, tanks, ships, locomotives, graders and other moving equipment, they simplify plumbing, save materials, space, weight, time and money.

Write today for new descriptive catalog covering the complete *hi-g* line.

"DOWN HERE" K-10 PROVIDES SIX TIMES MORE POWER!

Used on air conditioning, combustion and refrigeration equipment, General Controls' K-10 . . . now in its 10th year . . . develops lever action six times more powerful than the ordinary solenoid valve. Two-wire, current failure. Quiet, easily installed. Handles air, gas, water, light and heavy oils, steam. Positive opening, complete shut-off. For normally open or closed; any voltage A.C. or D.C., up to 1¼" I.P.S., up to ⅝" port sizes. Write for catalog 52.

*TRADE MARK—*hi-g* indicates positive operation in any position, regardless of vibration, change of motion or acceleration.

hi-g
GENERAL CONTROLS

Wartime Manufacturers of Electro-Magnetic and Temperature Controls for Aircraft • Peacetime Producers of Automatic Pressure, Temperature, and Flow Controls

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War Contract Changes Increase Company Problems

Too many design changes or a change of product defeat volume production, but if military operations in the various war theaters require better materiel, it becomes necessary to improve existing weapons and vehicles, and in some cases to design and build new equipment. Design changes, production cut backs and contract cancellations usually present the affected company and its suppliers with difficult problems of readjustment. Automotive companies in particular have been confronted with this situation, including the cancellation by the Government of more than $2 billion of their prime contracts and subcontracts during the past 2½ years. A typical example is the case of the International Harvester Co., which in December, 1941, received a letter of intent to produce a new streamlined model tank. The former Bettendorf car shops were acquired near Davenport, Ia., and conversion to a tank plant was begun. The new tank underwent a multitude of engineering changes during its development stages. Orders for 5400 changes came through the Ordnance Dept. and the original 20-tank emerged as a 28-ton model.

Fifteen months later some progress had been made towards turning out finished tanks in spite of all the design changes. More than 250 tank hulls were completed before the first pilot model came off the line. Finally in March, 1943, seven pilot models and six production models had been built. Then, due to the success in combat of the M-4 medium and the M-5 light tanks, both already in production, the Army decided to abandon the new tank project and cancel the contract. A total of $36,500,000 already had been spent on the contract by International Harvester Co.

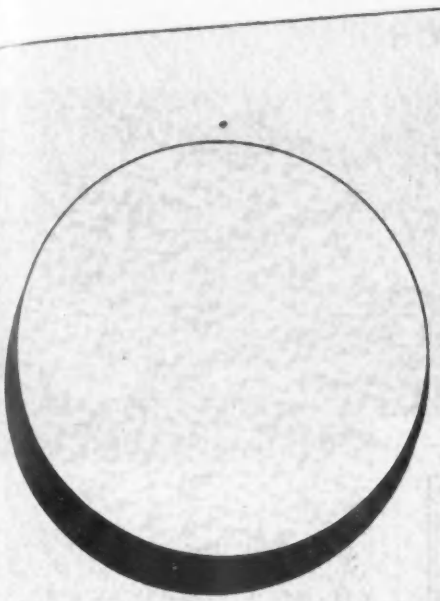
To make use of the International Harvester facilities at Bettendorf, the Ordnance Dept. awarded IHC a contract for the M-5 prime mover, an 18-ton open top tracked vehicle, carrying an eight-man crew and ammunition and hauling a 155-mm gun. The chief similarity between it and the tank which it succeeded was the track. In rearranging the floor space in the 1320 by 440 ft. plant for production of the prime mover, every one of the 1154 machines installed for tank manufacture and financed by the Defense Plants Corp., had to be moved. Eventually, 706 of these machines were converted to production of the prime mover. The remainder either were shipped to other companies or stored in a vacant part of the plant.

Only about 10 per cent of the tank's jigs and fixtures were convertible for use on the new contract. The rest had to be discarded as scrap, including a group of end-over fixtures for welding the front, rear and top of the tank. Pits used with these fixtures had to be filled in. The 250 tank hulls, each representing an expenditure of $16,000, were cut up and re-melted into scrap metal.

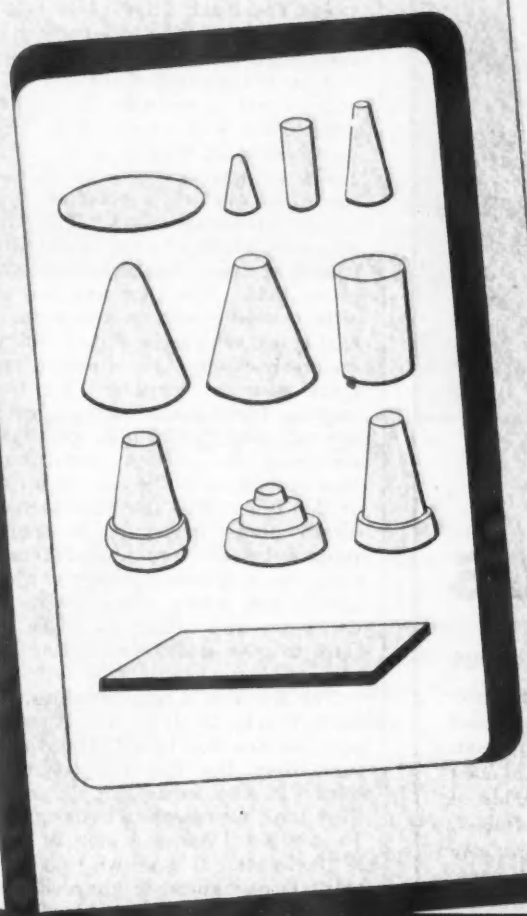
New bases had to be dug for a battery of drill presses to be used on the prime mover production. A month elapsed before delivery was completed on a network of individually-operated cranes used to handle heavy parts for the vehicle. A special drawing furnace with a 10-foot underground foundation had to be installed along with two open pits for handling the heated parts. However, the conversion from tanks to prime movers was made in three months. Some new labor had to be employed because 35 per cent of the company's best mechanics were lost in the changeover period.

Both International Harvester Co. and the Ordnance Dept. set up special termination departments to handle the contracts on the tank job. Of the 431 first tier subcontractors, 363 claims had been settled in full as of Dec. 31, 1943. Eleven were in the hands of Ordnance officers awaiting approval and 55 were being processed by IHC. Four of the largest claims have not been filed, awaiting all the claims from their subcontractors. The contract also involved 1500 suppliers as well as the subcontractors.

As of today the manufacture of prime movers is progressing smoothly. But indicative of the constant fluidity of warfare, this contract has been cut back 50 per cent.



Grade 3 Porex Magnified 5 Times



Put POREX *to work for you*

Porex is made from powdered metal. The primary objective was to produce a better and non-breakable filter. Subsequent developments show that with modifications it can perform specialized functions involved in the flow of liquids and gases.

NEW EFFICIENCY IN FILTRATION—SEPARATION—DIFFUSION—FLOW CONTROL—FLAME ARRESTING AND OTHER FUNCTIONS

Because of its unique structure, Porex presents an exceptionally large number of tortuous passages to any medium passing through it. This characteristic, together with the adaptability of the material to varied shapes and to "press fits," qualifies Porex for service on many applications requiring fine filtration, separation, diffusion and flow control. Wherever fine orifices, precision parts or polished surfaces must be safeguarded against harmful particles—wherever the form, content or rate of flow must be controlled—Porex is a logical solution to your problem.

You will want to investigate Porex thoroughly before proceeding with new product designs. It is serving today on well-known products in many fields. Moraine Products Division of General Motors Corporation, Dayton, Ohio.

WAR BONDS SAVE LIVES

MORAINE PRODUCTS
DIVISION OF
GENERAL MOTORS

Enemy Vehicles

(*Continued from page* 33)

gun of relatively high power. In 1942 the short barrel 75 mm gun was mounted. Also the 105 mm short barrel howitzer was introduced into later models. Likewise, the armament of the Kw IV tank started with a short barrel 75 mm gun, the power of which was increased in later models.

The entire series of German tanks was equipped with Maybach engines. Six cylinder engines of 100 and 140 hp, respectively, were used for the Kw I and II Tanks, and 12-cylinder V-engines of 320 hp were used in the Kw III, IV and early V. V-12 engines of 650 hp were used in the Kw VI. In all of the German tanks, the epicyclic type of steering using the clutch brake principle, but without differential between the track drives, was employed. This steering, while satisfactory, is not considered as good a steering mechanism as the controlled differential. As pointed out previously, the controlled differential was employed in the German half-track vehicles.

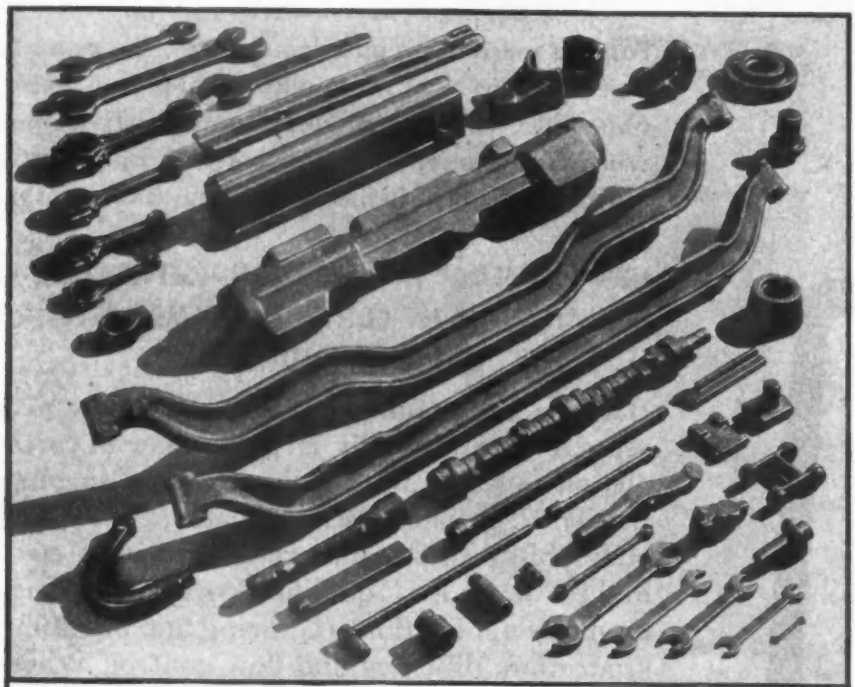
The steel tracks used on all German tanks consist of a common type of simple pin-jointed track. This track is strangely similar to the steel track employed in some American tanks up to about 1930. The Germans had an excellent needle-bearing track for their half-track vehicles and it is difficult to understand why this superior type of track was not employed for German tanks. Their tank track is good for approximately 600 miles and has high resistance to traction particularly at high speeds, as is the case of all tracks of this type. The Germans turned this disadvantage, in having to frequently replace tracks, into an advantage by carrying a generous supply of track shoes; and piling these tracks up at the front and along the sides of the tank to give additional armor protection.

The Kw V is a new tank designed in 1939 which, to date, has been rarely seen on any battlefield. It is a larger tank than the Kw IV, weighing 36 tons. It also mounts a 75 mm gun. This tank represents a redesign of the Panzer Kw IV and a step in advance of the latter. It is shown that the Germans have vigorously guarded the secret development of this tank. The latest modification is believed to be the German Panther Tank, mounting a very high velocity 75 mm gun and utilizing the engine, transmission, suspension and tracks of the Panzer Kw VI Tank.

The German Kw VI, also refererd to as the Tiger tank, follows in general the basic German design for tanks, with engine in rear with transmission and

Under New Management

U. S. Army forces captured this light Jap tank at Makin when that Gilbert Island stronghold fell to them Nov., 1943. It was transferred to Oahu, Hawaii, for training use. ***(Official U. S. Army photo from Acme).***



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Are you interested in procuring drop forgings which conform to exacting specifications, and which are free from defects? If so, it will pay to remember the name Herbrand.

Since 1881 Herbrand has been faithfully producing quality products which reflect precise and skillful craftsmanship, and at the present time our great plants are going at top speed to produce precision forgings for war needs.

Our modern facilities include steam hammers, board hammers, upset machines, bending machines, heat treating and die making equipment. We are excellently equipped to meet any challenge for the production of quality forgings, upset or drop forged, any shape or size up to 200 lbs., as may be required for post-war production.

Today the counsel of the Herbrand engineering staff is available to help solve present war production problems, or for post-war planning . . . Your inquiries are solicited.

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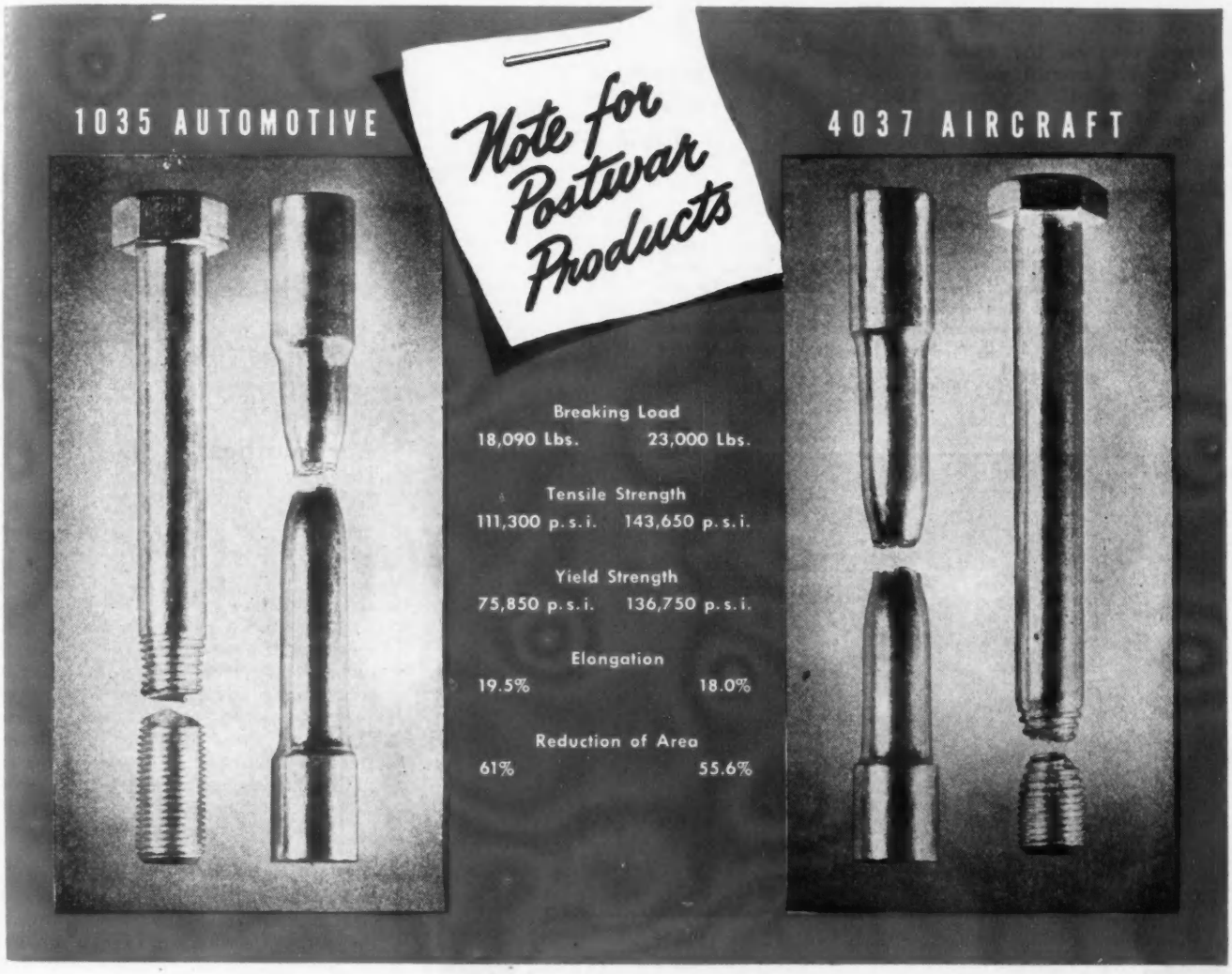


HOW AIRCRAFT STEEL HAS INCREASED *FASTENING STRENGTH*

Prior to the war, 1035 steel was considered about top-notch quality for a bolt—the standard for automotive use. Some bolts and cap screws were made of 2330 (high nickel steel) or 3135 (chrome nickel steel) but these were regarded as high priced specialties.

War needs for aircraft required better fastenings in huge quantities, and scarcity of alloys forced the use of newly developed "emergency" steels, particularly 4037.

This steel has been amazingly successful, both in performance and in its qualities for fabrication into tough fastenings. It gives physicals at least equivalent to those found in more expensive, harder working, higher alloy steels.

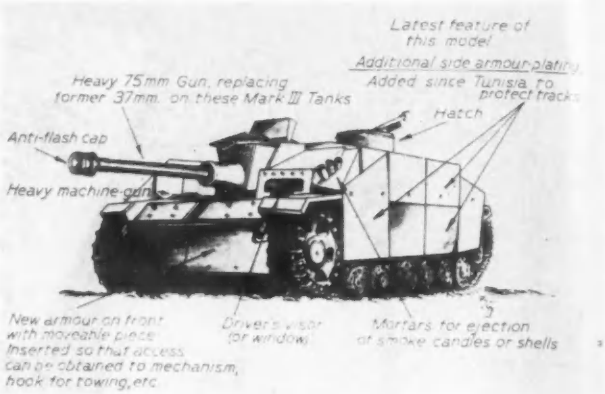
As shown above, 4037 is much stronger than 1035 steel, but it is not a great deal more expensive. It means better postwar fastenings in automotive and many other important applications.

National
HEADED AND THREADED
PRODUCTS

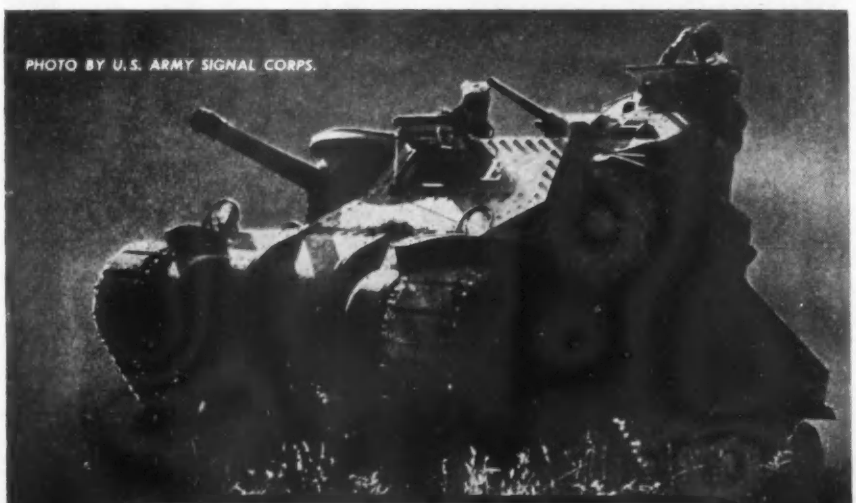
THE NATIONAL SCREW & MFG. CO., CLEVELAND 4, O.

drive sprocket in the front. The armor used on the sides is 3¼ in. thick. The overall weight of the vehicle is 67 U. S. tons. The gun mounted in the Mk VI tanks is the German 88 mm gun. The tank is watertight throughout and was apparently designed for crossing rivers in Russia.

Improved Mark III Tank


Latest feature of this model
Additional side armour plating added since Tunisia, to protect tracks
Heavy 75mm Gun, replacing former 37mm. on these Mark III Tanks
Hatch
Anti-flash cap
Heavy machine-gun
New armour on front with moveable piece inserted so that access can be obtained to mechanism, hook for towing, etc.
Driver's visor (or window)
Mortars for ejection of smoke candles or shells

For operations in Italy, the Germans have added several improvements to their Mark III tank, including a 75-mm gun in the turret and armor plates at the front and sides as shown in this drawing, which was made by B. C. Wood of the London *Sphere* staff and is copyrighted in this country by King Features Syndicate, Inc.



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STERLING ALUMINUM PRODUCTS INC.
Saint Louis, Missouri

LET'S GO! U.S.A. KEEP 'EM ROLLING

STERLING
PISTONS

Aeronautical Institute Meeting

(*Continued from page* 28)

and the turbo-governor. The pilot regulates the turbo boosts on the four engines simultaneously by the setting the turbo-boost selector, which is calibrated according to the manifold pressures required to obtain various speeds of level flight and rates of climb at different airplane loadings. Pressure of the air supplied to the carburetor by the turbosupercharger is measured electrically by the Pressuretrol. The turbo-governor, a safety device driven by a flexible shaft from the gear-type oil pump of the turbosupercharger, has two mechanisms—one that prevents the turbosupercharger from exceeding its safe operating speed. The other unit, an accelerometer, anticipates the pressure increase from turbo acceleration and provides a potentiometer movement to introduce a signal to start opening of the waste gate in time to prevent overshooting of the manifold pressure.

An intermediate unit between the control units and waste gate motor is the turbo amplifier, which receives two kinds of signals from the other control units, one calling for rotation to open the waste gate, the other to close the waste gate. It determines the direction of the waste gate called for and controls the power to the waste gate accordingly. The potentiometer in each of the control units—turbo-boost selector, turbo-governor and Pressuretrol, is interconnected with the balancing potentiometer in the waste gate motor to form an electrical "bridge" circuit, of three distinct section, each of which produces voltage signals.

Typical operational curves for an electronic-controlled turbosupercharged engine at a manifold pressure of 37 in. during a climb from 5000 to 32,000 ft altitude are shown in Fig. 2. After the propeller governor control is set for the desired engine rpm, which remains constant throughout the climb, the 37 in. manifold pressure is established by means of the turbo-selector. When the turbine reaches its maximum allowable

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13 Films Adhere Tenaciously and [illegible]

14 Microscopically Fine Particles.

15 An Excellent Suspension

Available as a smooth, black, liquid concentrate, Dag colloidal graphite puts a versatile company of physical and chemical properties at your service. Fifteen of the more important of these properties are listed here with a different color given to each for easy reference.

Match these properties by color with the colors on the medals below. Each medal represents a typical performance "citation" to Dag colloidal graphite. Dozens more could be shown, if space permitted, because this product is a dry film, a fluid film, a surface coating, an impregnation—and a few other things besides.

"Mr. Dag"

2 14 13 15

2, 14, 13, 15 CITATION: "Drive belts and other nonconductors traveling at high speed accumulate static charges which under certain conditions may constitute a hazard. This static electricity is controlled and bled-off harmlessly by a Dag colloidal graphite conductive film."

1 3 5 14 15

1, 3, 5, 14, 15 CITATION: "When the work rotating chuck of this large honing machine was assembled and run-in using Dag colloidal graphite, running-in time was reduced approximately 35%, operating temperature dropped considerably, and the danger of bearing damage due to temporary oil film failure was eliminated."

9 13 6 14 15

9, 13, 6, 14, 15 CITATION: "Dag colloidal graphite is used to retouch photograph negatives because of its complete opacity, because a film of minimum thickness is required and because it dries with a sharp edge."

PIN A MEDAL ON YOURSELF!

CHECK THE LIST and pick out those properties which you can use. Then state your problem to us and let our engineers give you the benefit of their experience. It is quite possible that they have already studied a parallel application. You'll pin a medal on yourself for calling in Mr. Dag.

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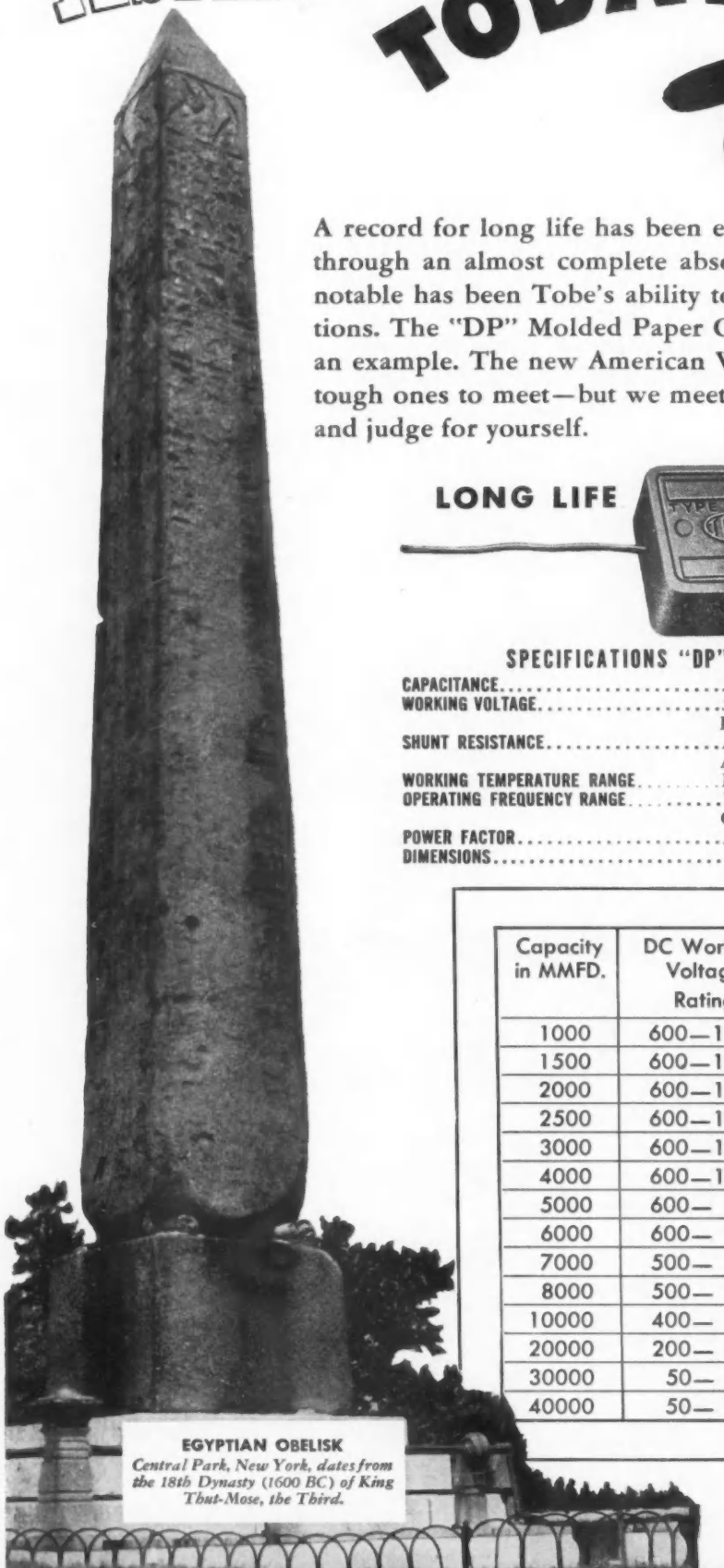
ACHESON COLLOIDS CORPORATION

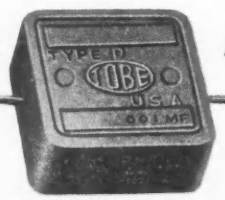
PORT HURON, MICHIGAN

YESTERDAY... TODAY... *Tomorrow*



EGYPTIAN OBELISK
Central Park, New York, dates from the 18th Dynasty (1600 BC) of King Thut-Mose, the Third.

A record for long life has been earned by Tobe Capacitors through an almost complete absence of "returns". Equally notable has been Tobe's ability to master difficult specifications. The "DP" Molded Paper Condenser shown below is an example. The new American War Standards "specs" are tough ones to meet—but we meet them. Ask us for samples and judge for yourself.

LONG LIFE  **ASSURED**

SPECIFICATIONS "DP" MOLDED PAPER CONDENSERS

CAPACITANCE.....001 to .04 MFD
WORKING VOLTAGE.....*See chart below*
Flash test 3 times rated DC working voltage
SHUNT RESISTANCE.....At 185° F— 1000 megohms or greater
At 72° F—50000 megohms or greater
WORKING TEMPERATURE RANGE.....Minus 50° F to plus 185° F
OPERATING FREQUENCY RANGE.....Upper limit 40 megacycles
Q at one megacycle—average 20
POWER FACTOR.....At 1000 cycles .004 to .006
DIMENSIONS.....13/16" x 13/16" x 19/64"

Capacity in MMFD.	DC Working Voltage Rating	TOBE & AMERICAN WAR STANDARDS DESIGNATIONS "A" Characteristic	"B"
1000	600—1500	CN35A102	CN35B102
1500	600—1500	CN35A152	CN35B152
2000	600—1500	CN35A202	CN35B202
2500	600—1250	CN35A252	CN35B252
3000	600—1000	CN35A302	CN35B302
4000	600—1000	CN35A402	CN35B402
5000	600— 800	CN35A502	CN35B502
6000	600— 800	CN35A602	CN35B602
7000	500— 700	CN35A702	CN35B702
8000	500— 700	CN35A802	CN35B802
10000	400— 600	CN35A103	CN35B103
20000	200— 300	CN35A203	CN35B203
30000	50— 150	CN35A303	CN35B303
40000	50— 100	CN35A403	CN35B403

TOBE DEUTSCHMANN CORP. TOBE CANTON · MASSACHUSETTS

A SMALL PART IN VICTORY TODAY — A BIG PART IN INDUSTRY TOMORROW

rpm, the overspeed unit of the turbo-governor prevents further increase in speed and afterwards the engine power falls off rapidly.

Uses of Indium

In 1927 and 1928 about 250 oz were the total production of indium in this country. Today about 500,000 oz. a year are available, William S. Murray, president of The Indium Corp. of America, revealed in his paper, "Indium in Aviation." A large amount of the indium production is for aviation engine bearings, principally of silver-lead-indium treated type. Many copper and bronze bearings also are treated with indium, since it practically prevents oil erosion due to acidity and in addition increases the fatigue strength of the bearing surface. As indium hardens silver and copper, a coating of it on these metals forms an alloy that improves the surface life considerably. Test results of zinc-indium coatings on hollow steel propeller blades indicate that this plating provides an excellent protection against corrosion and wear due to pitting. Since it wets metallic surface to advantage, indium also is being used in the assembly of hollow steel propeller blades.

Stall Warning Indicators

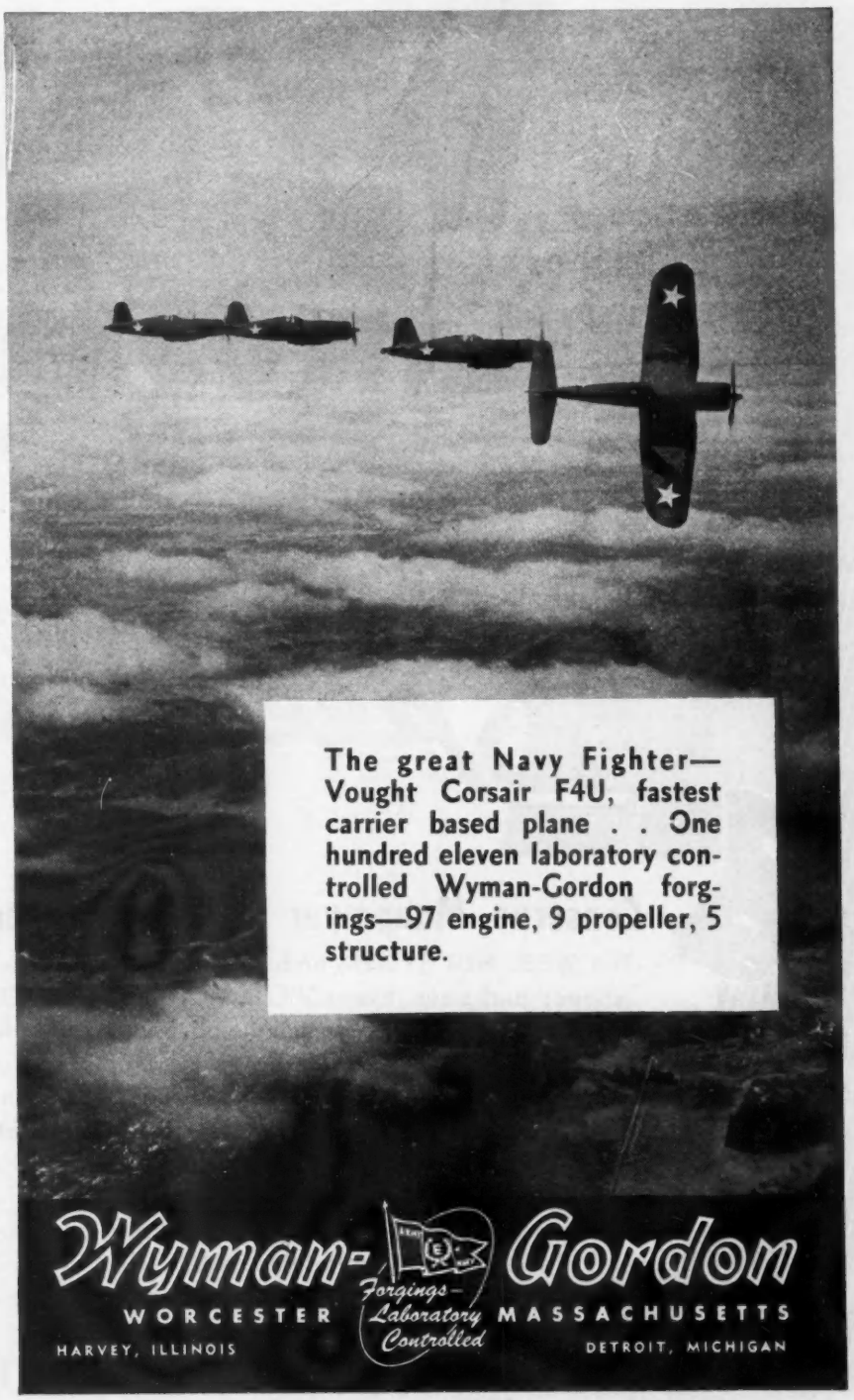
Statistics of the Civil Aeronautics Board show that 134 deaths resulted from stall and spin accidents during 1941, but that only 10 per cent of them were due to structural or powerplant failures. To reduce spin accidents to a low figure, the Technical Development Division of the CAA undertook the development of three stalling warning devices, two of which will be commercially available in the near future. Wind tunnel and flight tests have demonstrated that either of them will function successfully under all flight conditions except when ice has accumulated on the wings, which makes them suitable for use on privately-owned planes since wing icing is seldom a factor in stall accidents involving that type of aircraft.

Details of the program to develop stall warning indicators were related by James George of the CAA staff, who explained that the two devices are reliable, simple, low in cost, and easily installed and maintained. Consisting primarily of an aerodynamically-operated switch on the wing and a horn-light warning unit in the cabin, they are triggered at a predetermined angle of attack. One of them is a leading edge-vane type of instrument, a small projecting vane operating when the airflow direction at the wing leading edge changes from downward to upward. It was developed by the W. & L. E. Gurley Co., of Troy, N. Y. The other instrument, a diaphragm-switch unit located inside the wing leading edge at an opening and triggered to operate when the pressure at the opening reverses to suction, is a development of the Power Equipment Co., of Detroit, Mich.

The third project has for its purpose the development of a stall warning indicator for air-carrier planes that will provide an adequate warning margin even with wing icing. In 1943 a contract was let to the Westinghouse Electric & Manufacturing Co. to investigate a United Air Lines instrument, other pressure-differential actuated instruments and flow-actuated devices. A setup showing promise is a switch device located on the upper surface of the wing near the trailing edge and actuated by the changing character of the airflow.

Progress in Propeller Design

Full-feathering propellers have been the most valuable single contribution in the past decade to safety in flight of multi-engined aircraft, Col. H. M. McCoy, of the Wright Field propeller laboratory, declared in discussing the propeller design requirements of the U. S. Army Air Forces. So important is this design of propeller regarded, the Air Forces has developed several new types for engines under 500 hp. Experiments have shown that reverse pitch propellers are at least as effective in ground braking as the best wheel brakes and


The great Navy Fighter—Vought Corsair F4U, fastest carrier based plane . . One hundred eleven laboratory controlled Wyman-Gordon forgings—97 engine, 9 propeller, 5 structure.
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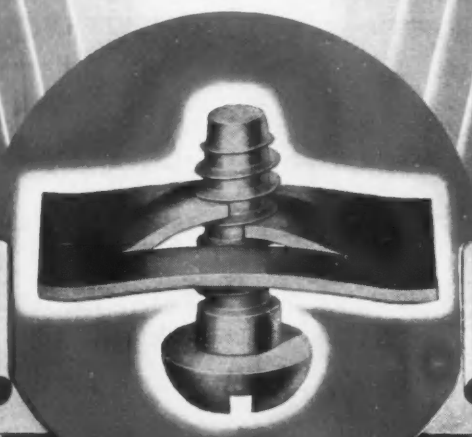
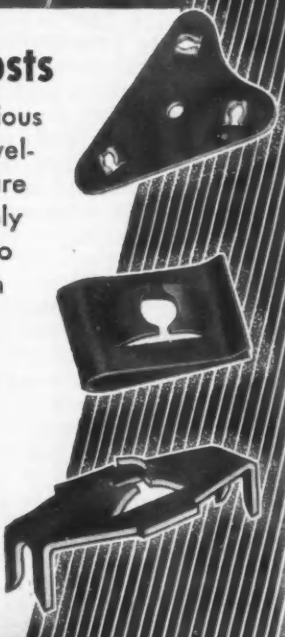


LIGHTER IN WEIGHT

RESIST VIBRATION LOOSENING

Speed Nuts



Conserve Manpower • Reduce Assembly Costs

The SPEED NUT SYSTEM embraces over 2000 fastenings in various shapes and sizes. Every SPEED NUT and SPEED CLIP was developed to do a better fastening job and to do it faster. All are lighter in weight... conserving metal, man-power and assembly costs. More important still, the SPEED NUT, engineered to accomplish a double spring-tension lock, resists vibration loosening as no other fastening. The six SPEED NUTS illustrated are merely typical of the wide range of shapes used in the assembly of metal, plastics, and wood. If you have not yet adopted the SPEED NUT SYSTEM of assembly wherever possible, a surprise is in store for you.

Write for summary catalog 185.

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are more effective thany any known flap-type dive brakes in retarding aircraft in flight. However, wheel brakes will be continued in use because they are more effective at slow speeds than reverse pitch braking and are needed for taxiing purposes.

The fire hazard of alcohol is too great to use it on warplanes in combat areas and since the standard alcohol slinger ring method has about reached the limit of usefulness as propeller diameters become larger and propeller rotation speeds slower, a solution of the propeller ice elimination problem is regarded as of immediate importance. One method having possibilities is an electrical system that has conductive rubber heating pads cemented to the blades and the current supplied by an electric geneator on the propeller hub. Anti-icing pastes, and lacquers are showing considerable promise. Then there is the possibility of using the exhaust gas in hollow blades for thermal elimination of ice.

To date the use of counter-rotating propellers is being limited to experimental airplanes.

Electrical-Mechanical Control Systems

Since the start of the war much engineering work has been directed to the development of electrical-mechanical systems for operating various devices and parts of aircraft with the result that many production and new airplanes now are being equipped with them, according to Richard M. Mock, vice-president and chief engineer of Lear Avia, Inc. This increased demand has made it possible for some companies to specialize in this field.

As an example of the rapid progress being made, Mr. Mock related the history of the development of a linear actuator, which performs the same functions as an hydraulic retracting cylinder. The first unit, built in the summer of 1942, weighed slightly over 5 lb. and had a peak operating load of 1000 lb-in. Improved in design when placed in production, it had a peak output of 1800 lb-in. and as recently designed the output is 3000 lb-in. with its weight still the same as the original unit. The mechanical efficiency for the gear box and screw was 18 per cent of the original unit, for the production unit 31 per cent, and for the most recent design it was raised to 41 per cent, which gives a lower current consumption per unit load.

In case of electrical failure in an electrical-mechanical system, there are several ways to provide in the design for mechanical emergency operation. They are manual operation of the unit by a hand crank or cable, direct hand cranking through flexible shaft, interconnection of two or more power units such as the two main wheel actuators and the nose wheel actuator, or release of the unit so that gravity will provide the necessary force, such as the lower-

Are Used Than All Other Chlorinated Solvents Combined

Perm-A-Clor, the most highly stabilized degreasing solvent, outperforms all others under adverse conditions of light, heat, moisture and combinations of different metals. It is more stable in all stages—as a liquid, vapor and condensate.

Triad cleans just as efficiently as Perm-A-Clor. It, however, is stabilized for less rigorous conditions.

When used in your degreasing equipment, you can readily see why these Detrex solvents are America's first choice by a wide margin, just as in Peace Time.

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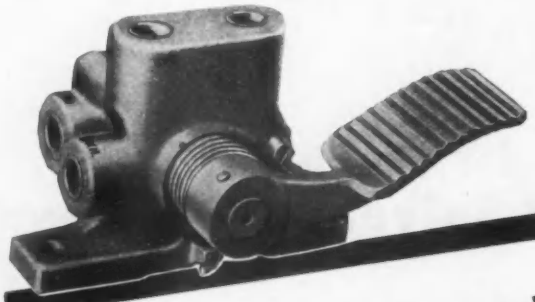
ing of the landing gear. Mr. Mock also discussed the various type of control such as limit switches, current and torque overload devices, a remote preset device having a mechanical follow-up, electrical positioning circuit with remote control, and automatic electronic controls.

Flexible shafting also can be utilized to advantage, power losses with it being about the same as those in a single stage, spur gear train. One installation on a tricycle landing gear has a separate power unit with all three wheel connected to a single gear box, the length of the flexible shafting to the main wheel actuator being 320 in. on each side. Wing flaps of this airplane are operated through a flexible shafting system with a flexible shaft over 300 in. long on each side of the fuselage.

Wood Use In Aircraft

The use of wood in aircraft has been retarded by the extreme shortage of data on the strength and elastic properties of that material, the situation being further affected due to the fact that few engineers have had practical experience in wood aircraft design or manufacture, Robert W. Hess, head of wood and plastics research at the Curtiss-Wright Corp. stated in his paper, "The Trend of Wood Use in Aircraft." It was pointed out that in wood structural design the critical effect of stress concentrations has been very troublesome, particular points of difficulty being at bearing points for bolts, at cutouts in a composite structure, in certain types of panel loadings, and where heavy solid members are joined to thin plywood panels. Usually the difficulty arises when the designer uses the compressive strength or shearing strength parallel to the grain of the wood only to find that due to the irregularities of loading, of stress distribution, or of grain direction only a portion of this strength can be used.

Of the recent developments, the synthetic resin adhesives are regarded as most important, particularly the new wood to metal bonding materials, the best of which provide bond strengths well above the shear strength of any wood, Mr. Hess stated. The possibilities of eliminating much of the excessive weight penalties of bolted fittings and better distribution of stresses seem promising.



NOPAK Model R, 2-3-and 4-way Foot Valve with spring return may be adapted to a wide variety of operating cycles.

NOPAK Foot Valves
Leave Both Hands FREE!

Foot control of air or hydraulic machine movements has proved valuable in speeding up production on a wide variety of applications. It leaves operators' hands free for other tasks, reduces fatigue. NOPAK 2-, 3- and 4-Way Foot valves are built in Spring Return, Ratchet and Double-Treadle Types, affording various operating cycles for the control of single and double acting air or low pressure hydraulic (either water or oil) cylinders. Write for Bulletin 86.

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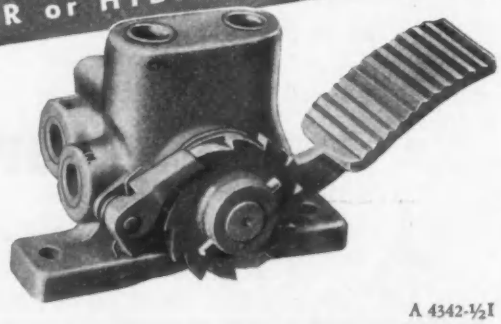
NOPAK VALVES and CYLINDERS
DESIGNED for AIR or HYDRAULIC SERVICE



NOPAK Model F, 2-3-and 4-way Foot Valve with ratchet pedal is particularly adapted to applications where operator must leave valve location after applying pressure.

A 4342-½I

Plastic Pellets Remove Carbon

The Army Air Forces have found a new use for plastics in some of the air depots in this country and abroad. They are now using Tenite plastic pellets in sand-blasting equipment to remove carbon from piston walls and the narrow

Tenite pellets

piston ring grooves. So successful has this new method of carbon removal proved that commercial airlines are installing equipment to service their planes in the same manner.

Flying Boat Loading Instrument Developed

(*Continued from page* 38)

center of gravity. A second version is operated by air pressure. Pressures from points on the bottom of the hull are transmitted to gages similar in construction to sensitive altimeters. The dials of these gages can be calibrated to read weight and center of gravity. Which of these methods will be found in flying boats of the future will be decided by construction costs and the preference of flying boat operators.

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★ **BONDING JUMPERS**

★ **CABLE ASSEMBLIES**

★ **AIRCRAFT and RADIO CABLE PRODUCTS**

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WHITAKER

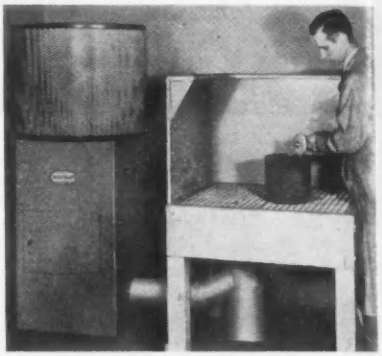
Cables, Wiring Harnesses and Assemblies for Automotive, Aircraft, Marine and Radio Equipment

New Production Equipment

(*Continued from page* 40)

own motor, fan, cyclone separator and filter complete. Installation is by connecting the intake of the Model 1250 Dustkop to the outlet of the bench.

Dust, dirt and lint drawn down through the 1000-lb capacity removable wood grill first encounters a horizontal baffle which spreads the suction of the air and also catches heavier pieces of work, as well as any tools which may be dropped through the grill. The heavier dust and dirt drop down through the funnel to the bottom of the stack, to be removed through a hand-hole clean-out, while the lighter dust enters the inlet of the Dustkop through the connecting pipe. A multiple bladed fan, direct driven by a 1½ hp motor, supplies suction at the working level and also sufficient pressure to assure high efficiency separation of the dust and air in the cyclone separator. The dust and dirt separated out by the cyclone, drops into a glass storage jar, while the cleaned air passes through the drum-type spun glass filter and recirculates throughout the working space.

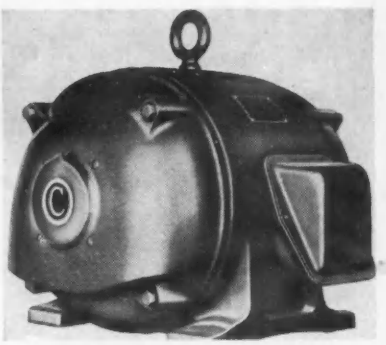


Dustkop portable dust-collecting unit

Rating of the Model 1250 Dustkop is 1200 cu ft of air per min at velocities upward of 4500 ft per min.

CENTURY Form J Splash Proof motors in sizes 1½ hp to 15 hp are now available with two-way ventilation.

The cooling air is drawn in through baffled openings in the bottom of the end brackets by a fan on each end of the rotor, blown through and around into all parts of the motor; and out through louvred openings in the side of the frame below the center line and at the bottom.



Century Form J Splash Proof motor.

This construction protects the vital parts of the motor during plant wash down or for outdoor operation. Century motors are a product of the Century Electric Co., St. Louis, Mo.

A CURRENT-REGULATING compensator for resistance welding machines has been announced by the General Electric Company, Schenectady, N. Y. The new compensator is specifically designed to facilitate consistent welds by holding the rms, or true heating value, of the weld current constant for any heat-control setting, without requiring continual manual adjustment.

After the predetermined heat-control setting for a particular job has been made on the compensator, it requires

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DRUMS
to meet your Specifications!
With us brake drums are a major item—necessary to the war effort—not a side line. We are brake drum specialists. All Brillion Brake Drums are made to meet the manufacturer's specifications. Not one is a stock item.
Brillion Brake Drums are cast high tensile strength gray iron, the finest that foundry skill and experience can manufacture. Today thousands of Brillion Brake Drums are in use on trucks and fighting equipment. Indicate your requirements and we'll carry on from there.
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BRAKE DRUMS

AIR POWER THROUGH

McQUAY-NORRIS
ALTINIZED
PISTON RINGS

PISTONS...PINS...
HARDENED AND GROUND PARTS

Every McQuay-Norris part in modern airplane motors is backed by 34 years of experience and progress in precision manufacture. Today the world's largest makers of aircraft motors are availing themselves of our broad background of metallurgical development, heat treating, clinical research and engineering design. Your inquiries are invited.

PISTON RINGS

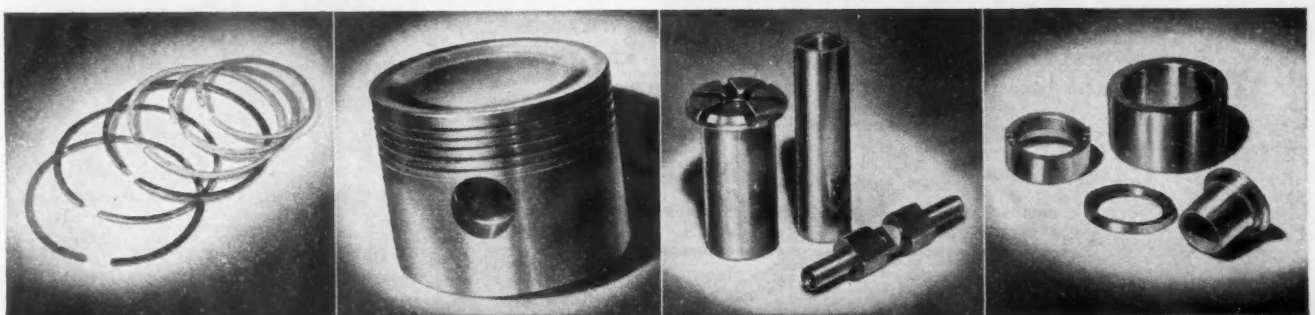
PARTS FOR AIRCRAFT ENGINES
Piston Rings
Oil Sealing Rings
Supercharger Rings
Carburetor Parts
Machined Aluminum Pistons
Piston Pins
Counterweight Cheek Pins
Machined Magnesium Parts
Cylinder Hold Down Nuts
Hardened and Ground Parts

PARTS FOR PROPELLER ASSEMBLY
Machined Magnesium Parts
Piston Rings

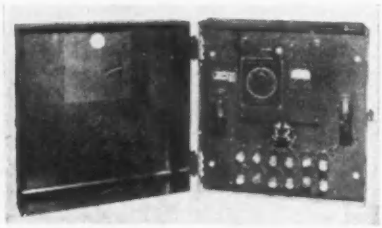
EQUIPMENT FOR MAINTENANCE OF AIRCRAFT
Pistons for Oxygen Compressor
Piston Rings for Oxygen Compressor
Pins for Oxygen Compressor
Pistons for Air Compressor
Pins for Air Compressor
Piston Rings for Air Compressor

LANDING GEAR PARTS
Machined Aluminum Pistons
Piston Rings
Hardened and Ground Parts

PRECISION WORKERS IN IRON, STEEL, ALUMINUM, BRONZE, MAGNESIUM



McQUAY-NORRIS MFG. CO. (AIRCRAFT DIVISION), ST. LOUIS, U.S.A.
CANADIAN PLANT, TORONTO, ONTARIO



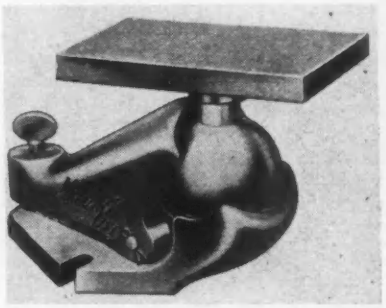
G-E current regulating compensator for resistance welding machines

no further adjustment. It will hold the welding current to a variation of plus or minus 2 per cent under the same conditions which would cause the unregulated welding current to vary plus or minus 20 per cent.

The compensator consists of an electronic control circuit which automatically retards or advances the firing point of the ignitron tubes used to control the welding current, thus holding the current constant regardless of line voltage changes or welding conditions. The compensator can be applied to most General Electric resistance welding controls which incorporate the phase-shift method of heat control.

THE Metro Positioner is a recently developed tool for holding or clamping work during production operations, such as checking, milling, drilling, shaping, boring, welding, filing, pattern making and similar work.

A vise or fixture may be bolted or fastened to the face plate of the tool, which will then permit tilting the clamped work at any desired angle. The Metro Positioner operates on the ball and socket principle and is quickly released or locked in position by a turn of the thumb screw. There are no graduations, the babbitt jaws give smooth operation and provide a rigid, non-slip hold.

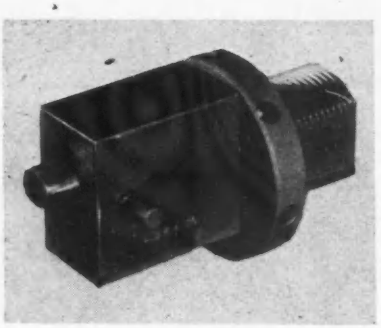


Metro Positioner

Metro-Vise Company, Detroit, Mich., offers the Metro Positioner in two standard sizes. The 4-in. size measures 7¼ in. high, has an 8 in. by 11 in. plate and weighs 58 lbs. The 3-in. size measures 5¾ in. high, has a 4 in. x 6 in. table and weighs 30 lbs.

THE American round pin type broach pull head, made by the American Broach & Machine Co., Ann Arbor, Mich., is designed for use in connection with small pull broaches having shanks ½-in. diameter and smaller. The shanks of the broaches for use with this pull head have a half-round groove across the pulling end.

On the new American round pin type broach pull head the broach, when inserted into the head, is pushed in to a point where the pin will automatically slip into the notch. There is sufficient mechanical pressure back of the pin to seat it positively in the slot in the shank. This not only provides for a positive pulling means but also a positive radial positioning of the broach.



American broach pull head

ACCURATE QUALITY

right to the Finish!

THE QUALITY in Accurate springs is built by a "step-by-step" procedure. One important step is taken in the plating department. Well-built springs can be spoiled there. That's why care, experienced workmanship and "know how" are the fundamentals of Accurate's finishing practice.

Accurate Springs

SPRINGS • WIREFORMS • STAMPINGS

ACCURATE SPRING MFG. CO., 3811 W. Lake St., Chicago 24, Ill.

Positive Identification of Ryerson Alloys

Confirms Quality . . . . . Prevents Shop Errors

Each bar of alloy steel in Ryerson stock is painted on the end to indicate the type of alloy . . . and then stamped on the side near the end with the number of the heat from which the bar was rolled. Smaller size bars are bundled and tagged with similar identification.

This is important to you, because it offers an unmistakable means of verifying the alloy steel you receive from Ryerson. Also, both heat number and color marking are recorded on the Ryerson Alloy Steel Report that is furnished with each alloy shipment. The Report Sheet contains accurate data on the analysis, working temperatures and the heat treatment response for quenched and drawn 1, 2, 3 and 4 inch rounds of the steel you receive. This gives you reliable information for heat treatment that will produce the desired result.

This unique and valuable Ryerson alloy service is one of many reasons why it will pay you to concentrate your steel purchases with us.

Joseph T. Ryerson & Son, Inc., Plants at: Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City.

RYERSON

The broach can be inserted into the pull head and will be automatically connected and can be released at any time by pushing the cross pin with the thumb and forefinger. If it is desired to automatically release the broach, provision is made in a plunger just above the bore which receives the broach. This plunger is tapped and an adjusting screw is inserted and adjusted so as to come in contact with the reducing bushing so that upon the return stroke of the broaching machine the pressure on this screw causes the plunger to recede, releasing the cross pulling pin, at which time the broach can be removed without touching the pull head.

When the broaching operation calls for a permanently locked broach, the knock-off screw in the plunger is removed. This permits a positive permanent locking of the broach and in this case the broach is only withdrawn manually when it is desired to remove it from the machine.

THE improved line of dial indicator adjustable snap gages offered by the Sheffield Corporation, Dayton, Ohio, fills a gap between the conventional snap gage and the high precision visual gage. They are available in 12 models, covering a range up to 12 in., with larger sizes supplied to customers' specifications.

Sheffield dial indicator adjustable snap gage

One of the applications of dial indicator snap gages is checking work as it is being brought down to size. Being as portable as a conventional snap gage, an operator can make a comparator type of check without removing work from the machine. It is also used for inspecting a finished part at the bench and for classifying parts of such size or weight as cannot be checked with other types of comparators.

The Sheffield dial indicator snap gage has a shock-proof dial indicator 2¼ in. in diameter, which is graduated in tenths (.0001 in.). It is of the balanced type, plus and minus .005 in. and range per revolution of the hand is .010 in. When properly set the hand will make 1¼ revolution in either direction, the total range of the indicator being .025 in.

The movable anvil is spring-urged and operates independently of the indicator spindle with a constant pressure, assuring the accuracy of the gage.

GEARGRIND straight groove drilling machines, Type GDS-1 and Type GDS-2, are the latest additions to the line of the Gear Grinding Machine Co., Detroit, Mich. These machines are used for cutting internal grooves in Rzeppa universal joints, but may be adapted for other uses.

The machines are automatic in operation. After work is loaded and the machine is started, cutting and indexing are automatic. After the last cut, machine stops automatically, permitting one operator to handle more than one machine. Hydraulic drive is provided, with variable speed control for drill traverse and indexing. Change gears for drill rotation have hardened and ground teeth. An 8-in. air-operated.

These ARROW Toughies see plenty of Action

Manufacturers of tanks, trucks, jeeps, planes, etc., are finding Arrow a dependable source of supply. And it is logical they should, too, for Arrow is an old hand at building these items. Arrow lighting equipment and other Arrow safety devices have a nation-wide reputation for strong, sturdy, trouble-free performance. Whether you are thinking in terms of present production or planning for post-war it will pay you to check with Arrow.

ARROW SAFETY DEVICE CO.
MT. HOLLY, N. J.

CLIP COSTS CUT

(2 WAYS)

1 Prices have been cut 3 times during the past year and now new reduced prices are announced on ADEL standard clips, thanks to ever-increasing standardization on the part of aircraft companies permitting mass production economies which are passed on to our customers. Today ADEL clip costs are down 75% under original prices. No reduction in *quality* or *variety*. Over 150 million in use. 12,000 types and sizes. 7 years of military and commercial service throughout the globe. *Prompt Deliveries* guaranteed to meet the toughest schedules.

ADEL

PRECISION PRODUCTS CORP.

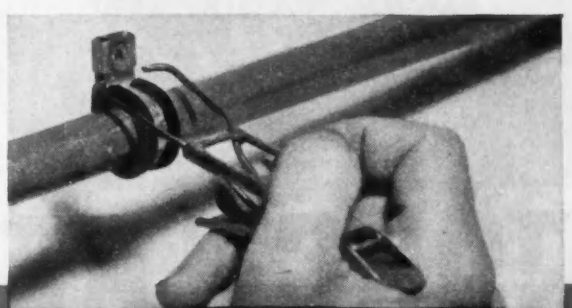
Burbank, California

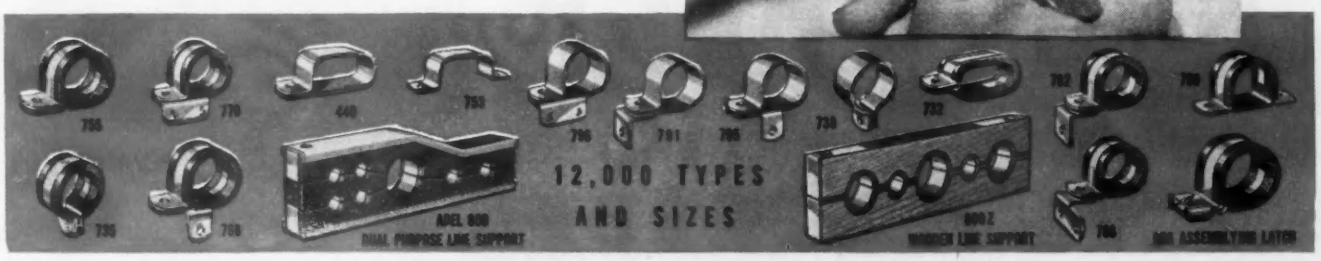
Huntington, W. Va.

Service Offices: Detroit · Hagerstown · Seattle

2 CLIP ASSEMBLY COSTS CUT, TOO!

New ADEL tool lessens finger-fatigue, speeds the work. Users report thousands of hours of assembly time saved. For *FREE SAMPLE*, instruction sheet and demonstration see nearest ADEL service engineer.





Geargrind Type GDS-2 straight groove drilling machine

3-jaw chuck is standard equipment on the Type GDS-1. The GDS-2, which has a larger capacity than the other model, is supplied with a 10-in. chuck of the same type. The hydraulically actuated, 3-pad equalizing steady rest operates automatically.

IMPROVED Peerless metal cutting power saws have been placed on the market by the Peerless Machine Co., Racine, Wis. A new hydraulic unit has been incorporated in these machines, and the hydraulic micro-set length gage is mounted on the conveyor to accurately gage the length of cut. Feed pressure is adjusted by vernier finger-tip screw control. Feed pressures can be selected to the accuracy of ounces. The oil capacity of the feed unit has been increased 75 per cent.

A Peerless feature is the four-sided saw-frame, which completely surrounds the blade and the work. Of special interest is the backing-plate blade-support which backs-up the blade to permit the application of maximum feed pressure with minimum strain on the blade. The

Peerless metal sawing machine

eight bearings on which the saw-frame and guide travel have been enlarged. Bearings have ground and renewable inserts. The saw-frame is balanced in its reciprocating travel by dual hydraulic cylinders. Driving rod to the saw-frame is connected in line with the center of the saw-frame. Driving force is always centrally applied. By increasing the chip capacity 60 per cent, fewer clean-up periods are required.

WILSON "Bumblebee" AC welders are now available in All-Weather models of 300 and 500 ampere capacities. These machines are similar to the standard Wilson "Bumblebee" AC welders, built by the Wilson Welder and Metals Co., New York, N. Y., except that they have special moisture-proof insulation throughout, and all parts are protected by a heavy coating of moisture-proof paint. The outer case is finished in weather-resisting enamel

All-Weather Type Wilson Bumblebee A C Welder

BORG & BECK

The Standard Clutch in Peace or War!

BORG & BECK DIVISION
BORG-WARNER CORPORATION
CHICAGO, ILLINOIS

TORSIONAL FORMING PRESS

A new, high speed method of positioning the throws of crankshafts is provided by this Clearing Hydraulic Press. The press offers many advantages, the most important being (1) bends produced in forging operations are accurately straightened; (2) crank pins are turned to correct positions in one fast operation; (3) crankshaft is rigidly and completely held during the entire forming operation to assure accuracy of twist and maintain perfect alignment; and (4) work is easy to load and unload since dies open to full length of work, and knockouts automatically loosen finished work.

The dies of this press receive a forged alloy steel crankshaft, with all the crank pins in one plane. The press as designed may be adjusted for twisting any six-pin crankshaft, where the crank pins and cheeks must be correlated to the conventional angularity of 120°. The bed is 90" long and die shoes are longitudinally adjustable to accommodate die inserts for any crankshaft up to 66" in length.

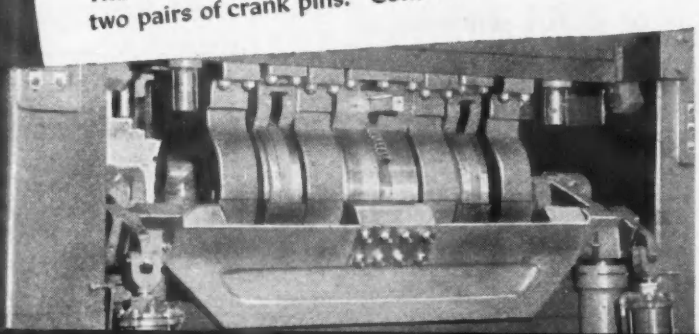
While your production may not concern crankshafts, this particular press is a good example of Clearing's willingness and ability to tackle and solve any problem presented. If you have a production operation, whether commonplace or unusual, where presses may be required, your inquiry is invited. Experience proves you can consult Clearing with confidence. Clearing Machine Corporation. 6499 West 65th Street, Chicago 38, Illinois

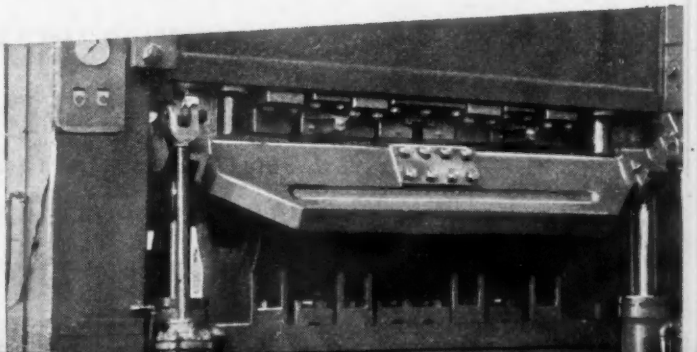
CLEARING HYDRAULIC AND MECHANICAL PRESSES

CMC CLEARING

Patent Pending

An assembly of four stationary and three rotating dies (below) hold the crankshaft and turn the crank pins. The stationary dies straighten and clamp the crankshaft under 250 tons pressure and maintain the forged position of one pair of crank pins. The rotating dies twist the other two pairs of crank pins. Controlled by a beam (below, right) on the front of the press, the center rotating die twists the center pair of crank pins 60°. The other two rotating dies, controlled by a beam on the back of the press, twist the remaining pair of pins 60°, so that 120° intervals exist between the three pairs of crank pins. The two beams are pivoted at their ends on common shafts which align with the centerline of the dies and work. Die design and knockouts permit easy removal of work. Pneumatic and hydraulic controls return dies to open and neutral positions, ready for a new work cycle.





Which Ozalid machine was designed for your drafting room?

A Model B . . . Like Grumman's
Grumman Aircraft Engineering Corp.
Bethpage, Long Island, New York

A Model F . . . Like Blaw-Knox's
Blaw-Knox Corporation
Pittsburgh, Pennsylvania

A Type 2600 . . . Like Standard Oil's
Standard Oil Company of New Jersey
Elizabeth, New Jersey

1. For large-scale print production. An Ozalid Model B will turn out whiteprints of your engineering drawings at speeds up to 20 feet per minute. Printing and Dry Developing are done in one continuous operation . . . and there are many exclusive features.

It can be relied upon for dependable and economical round-the-clock performance. *Price $2,850.00 F.O.B. Johnson City, New York.*

2. For medium production. The Model F is ideal when demands are moderate or occasional. It may also be used to supplement other equipment, or provide on-the-spot printmaking in departmentalized organizations.

The printer and developer are combined in one compact unit and whiteprints can be turned out at speeds up to 4 feet per minute. *Price $825.00 F.O.B. Johnson City, New York.*

3. For use with your present printer. If you have already installed expensive blueprinting equipment . . . you can add a Type 2600 Dry Developing unit and receive all the benefits of Ozalid Printmaking.

Expose Ozalid sensitized materials in your printer—then transfer to the Type 2600. Rate of development is approximately 5 feet per minute. *Price $370.00 F.O.B. Johnson City, New York.*

YOU CAN'T HAVE THIS VERSATILITY—WITHOUT AN OZALID MACHINE

Ozalid's Dry Development distinguishes it from all other printmaking processes. It eliminates baths, driers, plumbing connections—is responsible for compact machine design.

What's most important, it allows you to use a full line of sensitized materials and obtain exclusive printmaking "extras".

WITH OZALID YOU CAN:

Make prints having blue, black, maroon lines on white backgrounds.

Produce duplicate "originals"; reclaim soiled or worn tracings; eliminate drafting waste when making corrections.

Use cut sheets as well as roll stock—eliminate trimming waste.

Turn out all prints in the same manner. No variations in production.

WRITE FOR CATALOG AND SAMPLES OF OZALID WHITEPRINTS.

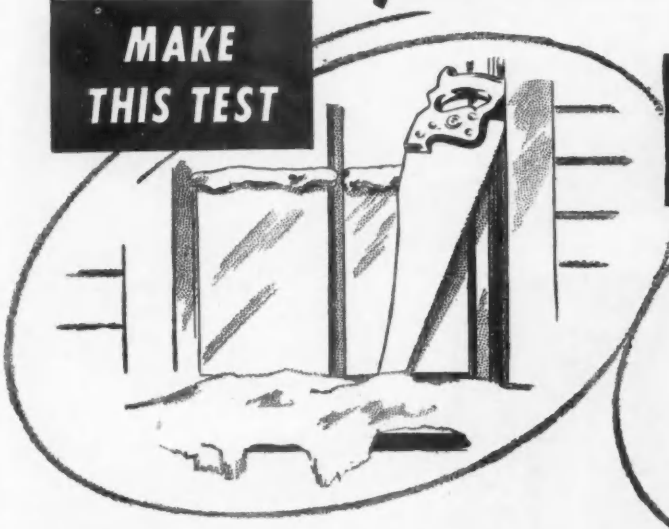
OZALID PRODUCTS DIVISION

GENERAL ANILINE AND FILM CORPORATION

JOHNSON CITY, N. Y. ★ OZALID IN CANADA—HUGHES OWENS CO., LTD., MONTREAL

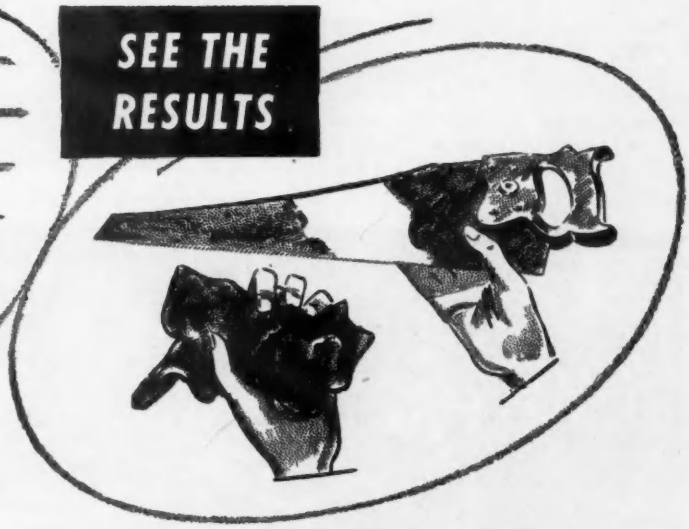
How to *prevent* Corrosion

MAKE THIS TEST



Coat a section of any piece of raw metal with a protective film of Anti-Corrode. Place it out-of-doors, and leave exposed to the elements.

SEE THE RESULTS



Rain, snow, changing temperature, dust and grime have eaten into and oxidized the unprotected metal. But note surface under Anti-Corrode film—bright and unharmed, in its original state.

CITIES SERVICE **ANTI-CORRODE** is a safe rust and corrosion preventive that brings amazing results. It is a reliable safeguard against corrosion of metals in any form or state of finish—whether in storage or in transit. Anti-Corrode forms a tenacious, durable film that is impervious to moisture and the more common gases prevalent in the atmosphere. And, since it contains lubricating material, it need not be removed in drawing operations. Anti-Corrode is made in several grades to meet specific requirements and severest tests. It is economical, easy to apply and can be removed with kerosene or any petroleum solvent.

This TEAM Will Save You Money and Materials

Recently, we announced the development of Cities Service Rust Remover, and responses to the demonstration offer far exceeded our expectations. Rust Remover, of course, *removes* rust. Anti-Corrode is designed to *prevent* rust and corrosion. Together, they will safeguard your equipment and war production—for the duration!

Take advantage of this FREE ANTI-CORRODE demonstration offer
Mail this coupon today!

(*Available only in Cities Service marketing territory EAST of the Rockies.*)

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NEW YORK · CHICAGO
IN THE SOUTH
ARKANSAS FUEL OIL COMPANY
SHREVEPORT, LA.

CITIES SERVICE OIL COMPANY
Room 123, Sixty Wall Tower, New York 5, New York

Gentlemen: I would like to test Anti-Corrode on my own equipment FREE OF CHARGE. Please send me the details.

Name_____

Company_____

Address_____

City_____ State_____

and has gaskets and louvers designed to prevent entrance of rain.

In addition, the All-Weather Wilson "Bumblebee" is equipped with a low voltage contactor which automatically holds the open circuit voltage at approximately 40 volts. When the operator strikes the arc, the low voltage contactor closes instantly and the transformer's performance thereafter equals that of machines not similarly equipped. When the arc is extinguished, this device immediately reduces the voltage back to 40 volts. In all other respects, these All-Weather models offer the same features as the standard Wilson "Bumblebee."

THE Ohio Crankshaft Company, Cleveland, Ohio, has introduced a low-cost 7½ kw output Tocco Junior induction machine which features a work unit separate from the power unit. If desired, the mobile top can be moved to facilitate shop operations. It is connected to the power unit by a cable that need not be limited as to length.

This newest of Tocco units provides a wide range of induction heating for brazing, annealing, heating for forming and for hardening small parts. Housed in a rigid welded steel cabinet, the unit is equipped with a vertical-type 220/440-volt, 3 phase, 60-cycle motor-generator set providing 9600 cycles of high frequency power.

Tocco Junior induction machine

The 30 in. by 36 in. lower unit which stands 30 in. high contains the motor generator, Tocco cycle controls, air filters and operating meters. The timer is located on the side of the cabinet as are field control switches. In the work or upper unit which measures 20½ in. by 17 in. and stands 16⅜ in. high are housed the high frequency transformer, condensers and the panel to which can be attached the work fixtures or inductor coils. For surface hardening the work unit will contain quench valve, manifold and gage. A stop and start push button with signal light is situated in the upper right hand corner of the unit.

Aircraft Propeller Hubs —by the thousands

are heat treated uniformly, automatically, continuously and without scale

in this EF special atmosphere installation

The equipment consists of a normalizing furnace, a hardening furnace, an automatic elevator type oil quenching machine, a washing machine, and a forced circulation draw furnace, arranged in line, in one complete continuous heat treating unit.

Everything is automatic from the time the hubs enter the normalizing furnace to the time they are discharged, scale free, from the draw furnace. The protective atmosphere used in the furnaces is produced in one of our EF special atmosphere generators.

The above is one of several similar production furnace installations we have built for scale-free normalizing hardening, and drawing various sizes of three- and four-blade propeller hubs, some of which weigh up to 100 pounds or more, each.

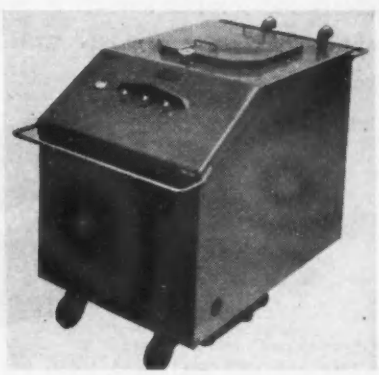
Your furnace problem probably does not require an installation as elaborate as the above. However, if you are interested in treating gears, springs, tubing, wire, stampings, machine screw products, castings, forgings, strip, or some of the hundreds of other essential war or postwar parts or products, we have probably built equipment similar to that required for your product, or are in position to build any special equipment needed to produce the results you want.

Telephone 4661 Salem, Ohio, or write us regarding your furnace problems. We specialize on building production furnaces—oil fired, gas fired, or electrically heated.

The Electric Furnace Co., Salem, Ohio

Gas Fired, Oil Fired and Electric Furnaces---For Any Process, Product or Production

Portable Heating Tank



This portable heating tank is a product of the Youngstown Miller Company, Sandusky, Ohio. It is called the Model 20, and consists of an insulated tank, a motor-driven pump for circulating the oil, thermostats for controlling the oil temperature, and control valves. The unit is mounted on casters

THERE IS ONE SURE METHOD OF KEEPING

THE LUBRICANT IN A BEARING AND

KEEPING EVERYTHING ELSE OUT...

HERE IT IS: "PERFECT"

CHICAGO RAWHIDE MANUFACTURING CO.

1310 ELSTON AVENUE · CHICAGO, ILLINOIS

PHILADELPHIA · CLEVELAND · NEW YORK · DETROIT · BOSTON
PITTSBURGH · CINCINNATI

65 Years Manufacturing Quality Mechanical Leather Goods Exclusively and now Sirvene Synthetic Products

New Products

(*Continued from page* 44)

are susceptible to these agents can, if necessary, be encased from head to foot in these safety garments which include hoods, aprons, gloves, smocks and sleeve guards. Even shoes may be completely coated with solutions of this same resin.

For women workers there are compar bonnets. These caps can be worn to protect the hair and scalp from oils and solvents as well as gases, fumes, dust, lint, etc., and at the same time keep the hair from tangling in machinery. They are self-ventilating, light weight, and adjustable to all average head sizes.

Lamps Released for Vital Transportation

Under the amended government order L158 Fog Lamps, spot lights, and back-up lights have been released for vital transportation. These new Arrow Fog Lamps, made by the Arrow Safety Device Co., Mount Holly, N. J., are available for this purpose. They have all-glass, Sealed Beam lighting units that will not depreciate, even after long periods of service. The lamps themselves have an all-weather, grey or black enamel finish.

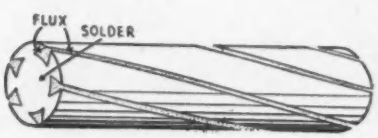
Oakite Compound No. 86 Available to All Plants

Previously restricted for exclusive use in war plants to meet production requirements for the better bonding of organic finishes and the prevention of rust in preparing steel parts for painting, lacquering and similar finishes, a new acid-type detergent, designed to clean and condition ferrous metals, has just been released to all types of metal working plants by Oakite Products, Inc., New York, N. Y.

Developed primarily for use in automatic washing machines, this new material, known as Oakite Compound No. 86, is reported to combine, in one operation, effective detergent action with special rust inhibiting surface treatment. The material thoroughly removes light spinning compounds, drawing lubricants, machining oils, grease, fingermarks and shop dirt and, at the same time, deposits on work a microscopic crystalline coating which provides the base for paint, lacquer and similar finishes.

Solder with Flux in Longitudinal Grooves

A fluxed wire solder, which contains flux in longitudinal grooves on the surface rather than in the conventional core, has just been placed on the market. The new material, called Fluxrite, is put out by National Lead Company, New York, N. Y. Since the flux is outside rather than inside, it liquefies and



Fluxrite wire solder

flows onto the work before the solder melts.

The new product, which contains a recently developed special flux, comes in the same diameters as regular cored solder. It is available in two compositions designated as Red Stripe and Green Stripe. These designations refer to the color of the flux which has been dyed in each case for easy identification.

Improved Motor Fizik

Announcement is made by The Curran Corporation, Everett, Mass., of an improvement in the formula of their product "Motor-Fizik." It is reported that the improved formula in addition to its usual application has been demonstrated effective as a gasoline tank anti-freeze. To prevent winter time gas line freezing a pint or quart of the improved formula may be simply added to the gasoline tank.

Rolled Bronze BEARINGS

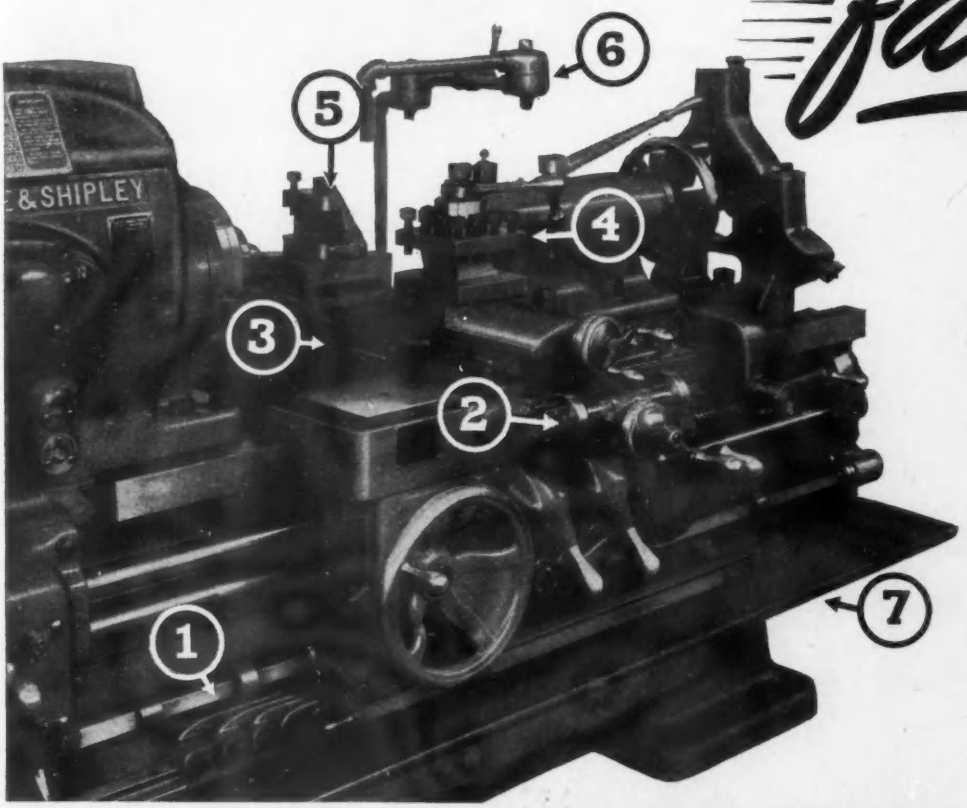
Engineers and designers for the future, in search of high quality thin-wall bearings, will do well to consider Johnson ROLLED BRONZE. By virtue of the material used and our method of manufacture, we are able to provide considerable resistance to pounding and to shock with excellent bearing performance and long bearing life. Any type of oil groove, slot or hole, can be incorporated, or the bearing can be serrated for graphite or ball indented to retain grease.

Also, Johnson ROLLED BRONZE is ideal for washers, thrust plates, or a wide variety of flat pieces.

It's an easy matter to determine if this type of bearing will give you the performance you desire. Simply call in a Johnson Engineer. Make full use of our more than thirty-five years' exclusive bearing experience. As we make ALL types of Sleeve Bearings we base our judgment on facts . . . free from prejudice. Can we be of service to you?

JOHNSON BRONZE
SLEEVE BEARING HEADQUARTERS
625 S. MILL STREET NEW CASTLE, PA.

Produce SMALL Lots *faster*



LATHES GOOD LATHES ONLY
SINCE 1892

ARMY E NAVY

Original Navy "E"
Awarded March 6, 1942

Why you save time with The Lodge & Shipley Manufacturing Lathe

Change over quickly and easily from one job to another.
Advantageous use of multiple tools and universal holders.
Transfer of diameter and length control from operator to lathe.

OUTSTANDING FEATURES

(1) Multiple Length stops (Telescopic Dog Type), automatically disengage longitudinal feeds.

(2) Multiple Diameter Stops, for both front and rear tools, can be quickly indexed for establishing diameters. Time wasting "cut and try" eliminated.

(3) Connected rear rest increases tooling possibilities. Adaptable to single or multiple tools.

(4) Four-way tool block on compound rest can be indexed for twelve equally spaced tool positions.

(5) High duty tool block in rear used for single tool can be supplemented or replaced with multiple holder.

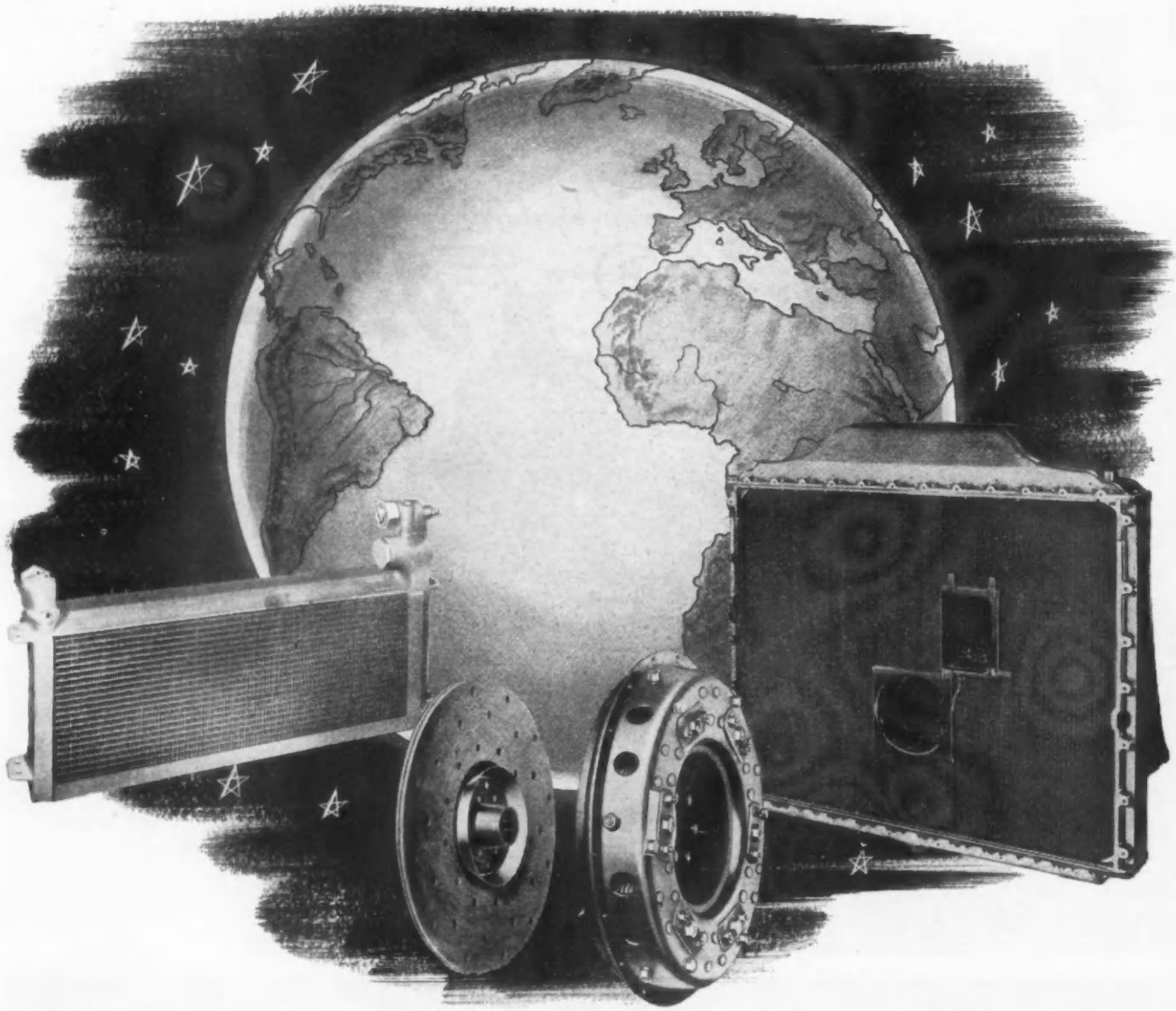
(6) Coolant pump and piping.

(7) Chip pan.

WRITE FOR PUBLICATION No. 482

THE LODGE & SHIPLEY MACHINE TOOL CO.
CINCINNATI, OHIO, U.S.A.

ENGINE TOOL ROOM AUTOMATIC OIL COUNTRY LATHES



ON THE FIRST, SECOND, THIRD, FOURTH AND FIFTH FRONTS...*Long Products Serve the Allies*

Long clutches, radiators and oil coolers serve the Allies on land, sea and in the air on every fighting front around the world from Russia to the Aleutians—on planes, tanks, trucks, jeeps, ships. They have demonstrated their efficiency on the toughest battle-fronts—and the ability of the Long organization to maintain both quantity and quality of their products has been recognized by the addition of a star to their Army-Navy "E" flag.

LONG MANUFACTURING DIVISION
BORG-WARNER CORPORATION
DETROIT 12, MICHIGAN • WINDSOR, CANADA

★ ★ ★ ★ **LONG** ★ ★ ★ ★

CLUTCHES • RADIATORS • OIL COOLERS

Keeping BOOST ON THE BUTTON!

The Simmonds-Hobson Automatic Engine Control

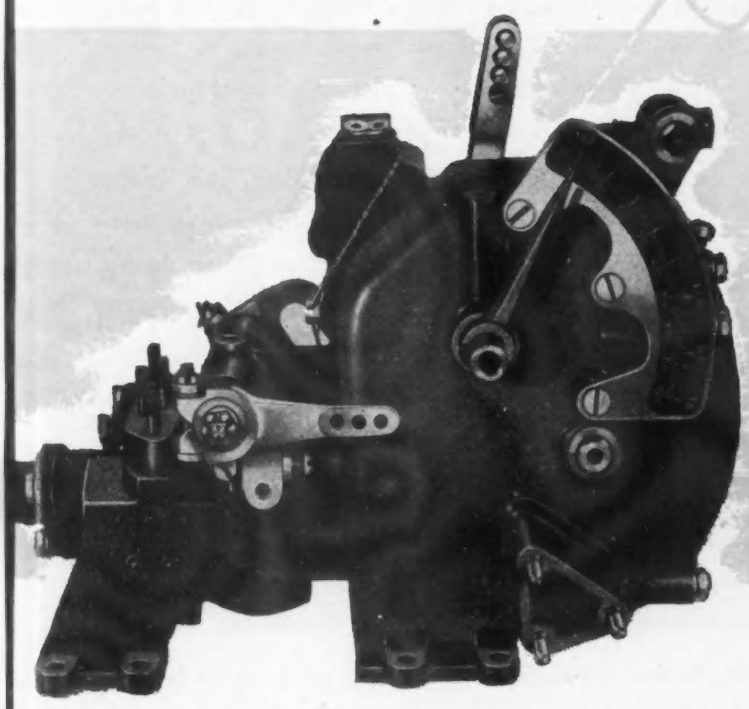
TAKE-OFF calls for split-second coordination of airplane, propeller, and engine controls. Climb at rated power...flight at cruising...all mean continuous adjustments of mixture, RPM, and manifold pressure which complicate a pilot's job.

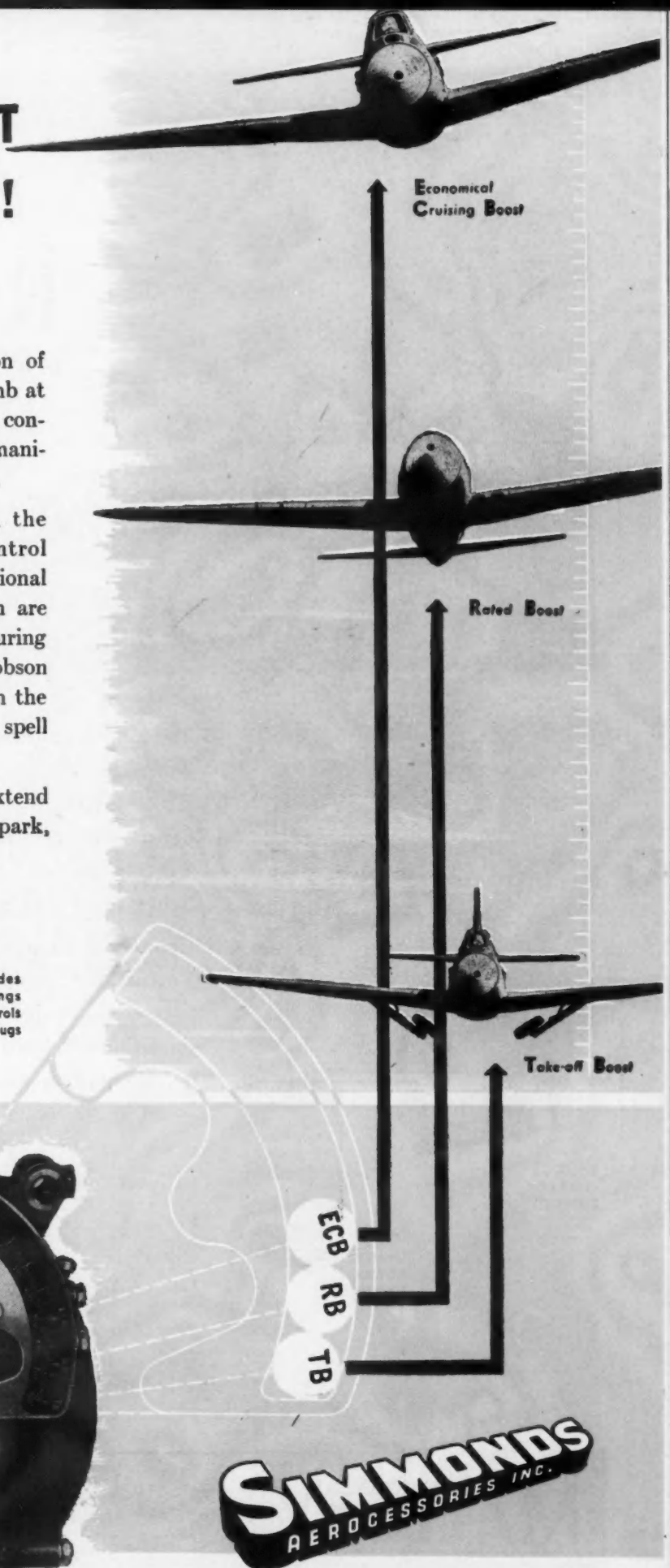
Acting as a third hand for the pilot, the Simmonds-Hobson Automatic Engine Control simplifies the pilot's task, and provides additional engine protection. Units now in production are designed to take over throttle and mixture during all conditions of operation. The Simmonds-Hobson Automatic Engine Control keeps "boost" on the button, and prevents mixtures which might spell disaster for the engine.

More advanced designs now under way extend automatic control to the propeller governor, spark, and other engine functions.

Simmonds Equipment Flies With Every Type of Allied Aircraft

Automatic Engine Controls • Chronometric Radiosondes
Hydraulic Accumulators • Self-Aligning Rod-End Bearings
Cowling and Panel Clips and Fasteners • Push-Pull Controls
Equipment and Components For Hydraulic Systems • Spark Plugs





SIMMONDS AEROCESSORIES INC.

10 ROCKEFELLER PLAZA, NEW YORK, N. Y.

On the Job for Pan American—

P.R. MALLORY & CO. Inc.

MALLORY Rectostarter*

AVIATION BATTERY CHARGERS

RECTIFIER POWER SUPPLIES

UTILITY POWER SUPPLIES

To help maintain its crowded war-time schedule, Pan American World Airways depends increasingly upon the Rectostarter. They've learned, through actual use, the dependability of this Mallory portable DC power supply in starting aircraft engines and as a source of power for plane lights, radio and instruments while on the ground.

Connected to any 230 or 460 Volt 3 phase AC outlet, the Rectostarter provides a continuous source of DC current that is unaffected by temperature variations or weather conditions. It features the "Time-Tried and Proven" Mallory magnesium copper sulphide rectifiers with no moving parts —nothing to wear out. And in addition to starting power, it can be used to taper charge 12 and 24 volt aircraft batteries without removing them from the plane.

For applications that do not require portability, the Rectostarter is also available in stationary units with one or more DC outlets. See your Mallory distributor, or write direct.

Help Win the War— Buy Bonds

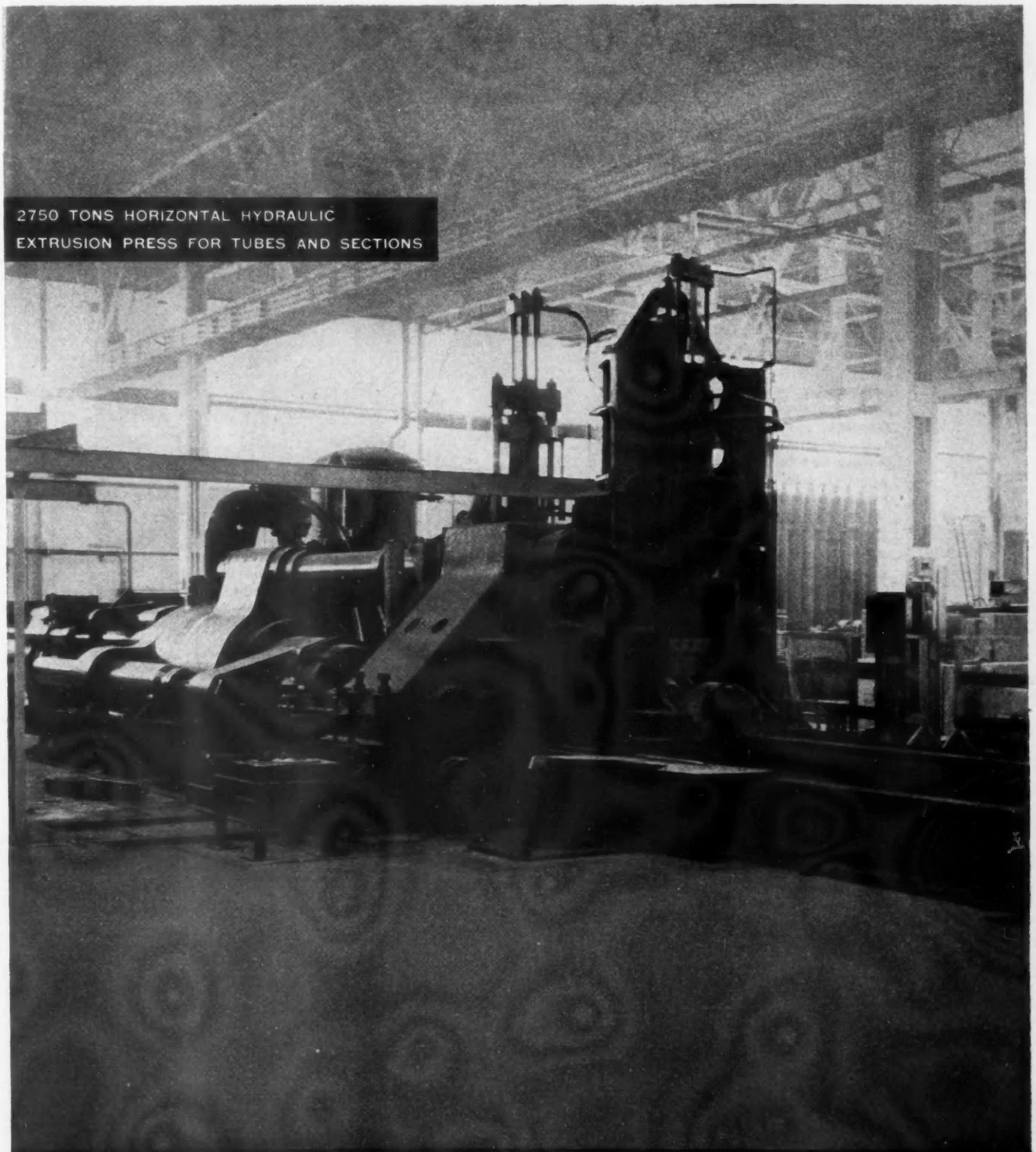
P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

**Rectostarter is the registered trademark of P. R. Mallory & Co., Inc., for rectifier units for use in starting internal combustion engines*

P.R. MALLORY & CO. Inc.

MALLORY

MAGNESIUM COPPER SULPHIDE RECTIFIERS— STATIONARY AND PORTABLE D. C. POWER SUPPLIES— BATTERY CHARGERS AND AVIATION RECTOSTARTERS*



HYDROPRESS · INC.

ENGINEERS CONTRACTORS

HYDRAULIC PRESSES · ROLLING MILLS
STRETCHERS · PUMPS · ACCUMULATORS

570 LEXINGTON AVENUE · NEW YORK · N Y

This advertisement is one of a series which is appearing in national magazines and newspapers as Consolidated Vultee's contribution toward a clearer public understanding of transportation's role in the war, and its postwar opportunities and responsibilities.

"Axis air base falls to Allies"... Now what?

WHEN YOU READ that Allied paratroops have captured another enemy air base, don't be too quick to say, "Now, by using this new base, our bombers can strike even deeper into the heart of industrial Germany."

It's not quite so simple as that. An Axis air base doesn't become an Allied air base merely because it has been wrested from the enemy.

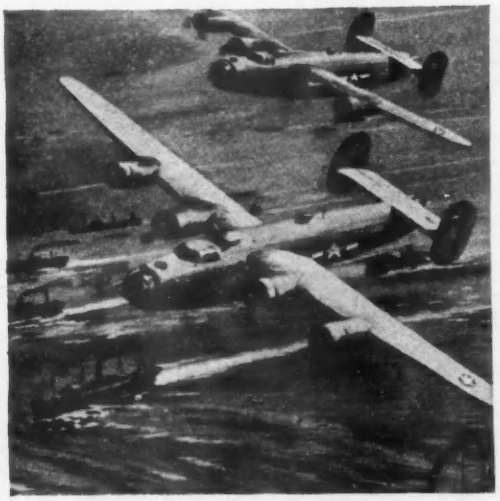
Before a single bomber can take off with its load of block-busters, there is a colossal job to be done — a job which requires the combined efforts of the airplane, the truck, the train, and the ship. That's something the communiques never tell you about . . .

1. First come the air-borne reinforcement troops, landing on the bomb-pocked runways. Then a second wave of planes, carrying an aviation engineer battalion, "pee-wee" tractors, scrapers, and lightweight construction equipment. An emergency landing strip is smoothed off for fighter planes, and transport planes with heavier tractors, scrapers, and rollers.

2. Then, the trucks come in, with gasoline and oil drums, bombs, and food. Others lug in heavy cement mixers, giant bulldozers, and tumble-buggies — so that the engineer battalions can build permanent runways for all-weather bomber operation. By this time, transport planes have flown in carrying operational personnel, radio equipment, spare bomber engines and parts.

3. Now the heavy sluggers roar in — the big, long-range Liberators and their crews. Transports fly in, too, bringing the ground crews who will ready the bombers for action. At last — perhaps weeks after the air base fell into our hands — the Bomber Command is ready to strike. How hard can it strike — and how long? That all depends on the vital link in the chain . . .

CONSOLIDATED VULTEE



4. This link is the never-ending stream of cargo ships. For the problem of supply cannot be solved by air alone. Transporting the equipment needed to *keep* a bomber base in operation is a job in which everything that rolls, floats, and flies must join forces.

The way this challenge has been met is more than a heroic saga in the tightening of the air ring about the Axis. It is a lesson we must remember for the peacetime years that lie ahead.

5. An enduring peace will depend, in great part, on the unhampered interchange of people, goods, and ideas between the nations of the earth.

And while all forms of transportation are teaming up to meet this postwar challenge, the plane, for one, must play a second, and possibly an even more important role: *that of policing this 60-hour-wide world.*

For the maintenance of an adequate Air Force, for years to come, will be one of the cheapest premiums America could possibly pay for insuring the peace which we shall have won.

Quick Facts for Air-Minded Readers

No ice needed — *Much of the nation's perishable commodities, such as fish, fruit, meat, and flowers, may be transported by air, someday soon. In a plane flying above 20,000 feet, no refrigeration would be required.*

• • •

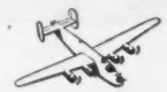
Speed, not cost — The Air Transport Command, using such planes as the huge, long-range Liberator Express, is daily flying hundreds of tons of vital equipment over our global skyways. Speed, not cost, is the all-important thing when our fighting men need blood plasma, more ammunition, or replacement parts. By plane, they get these things in a matter of *hours*, not days or weeks. In the postwar period, as planes are still further improved and new economies are effected, low rates will make commercial air freight practical for many products.

• • •

Exit the iron horse? "I have no illusions that the airplane will make the railroads obsolete. On the contrary, there will be room and plenty of need after the war for more and better transportation by rail, highway, water, and air." — TOM M. GIRDLER, Chairman of the Board, Consolidated Vultee Aircraft Corp.

No spot on earth is more than 60 hours' flying time from your local airport

From Flying Jeeps to Leviathans of the air — *Consolidated Vultee now builds many types of war planes, from small trainers to long-range bombers. When peace comes, the company will be in a position to provide the postwar equivalent of such planes, from small privately owned "air flivvers" to huge transoceanic passenger-and-cargo planes.*



LIBERATOR . . . 4-engine bomber

LIBERATOR EXPRESS . . . transport

CORONADO . . . patrol bomber

CATALINA . . . patrol bomber

VENGEANCE . . . dive bomber

VALIANT . . . basic trainer

RELIANT . . . navigational trainer

SENTINEL . . . "Flying Jeep"

AIRCRAFT

San Diego, Calif. · Vultee Field, Calif. · Tucson, Ariz. · Fort Worth, Texas · New Orleans, La. · Louisville, Ky. · Wayne, Mich. · Dearborn, Mich. · Allentown, Pa. · Nashville, Tenn. · Elizabeth City, N. C. · Miami, Fla.

Member, Aircraft War Production Council

WIDE RIMS..

another reason for lighter weight *Aluminum*

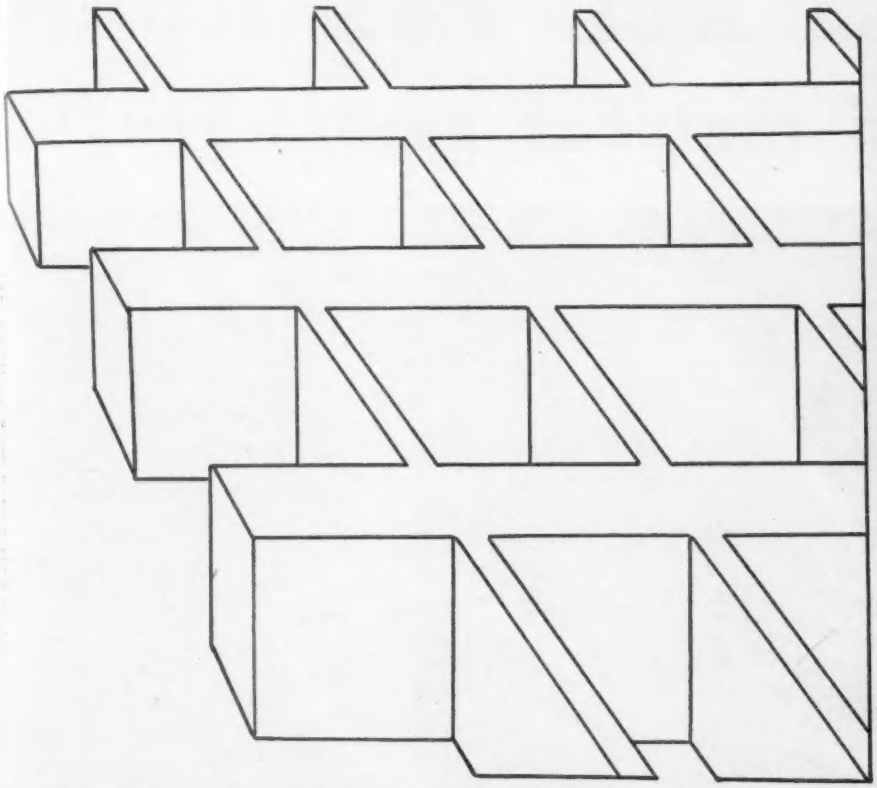
Wide-base rims, advocated as a means of reducing tire wear, may defeat their purpose unless their weight is held down. That's unsprung weight, tough on tires and wheel supports. So, figure on what lightweight Alcoa Aluminum will do here.

Tire manufacturers long ago recognized that, if they could cut rim weight, they could thereby lengthen tire life. Logically, they turned to aluminum as a means of accomplishing this weight-saving. Trucks and buses were equipped with aluminum rims, but this experimental work was stopped when all aluminum was assigned to war uses.

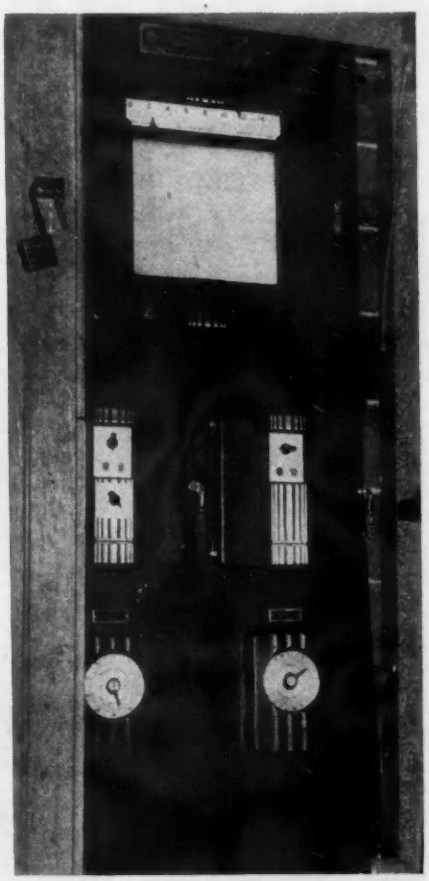
With aluminum becoming more available, this might be a fine time to revive this work. Save rubber and conserve labor by mounting wide-base tires on lightweight aluminum rims.

The extruded shape shown above was one of the early rim shapes produced by Alcoa for a tire company. Formed into a circle and welded, this made a rim which was inexpensive to manufacture and was correct in every detail. The extrusion process places metal exactly where it is needed for functional and service purposes. ALUMINUM COMPANY OF AMERICA, 2110 Gulf Bldg., Pittsburgh, Pennsylvania.

ALCOA ALUMINUM



Censorship prohibits photos of the actual weldments referred to in this advertisement, but the sketch of an imaginary structure features the thick-and-thin sections of the weldments, castings and forgings to the annealing of which this new development in Micromax Control applies.



Micromax Program-Control Pyrometer for car-bottom stress-relieving furnace used by Welding Engineers, Inc., Norristown, Pa.

WARP IN STRESS-RELIEF OF INTRICATE WELDMENTS IS REDUCED BY MICROMAX CONTROL

Distortion has ceased to be a problem in several plants where intricate weldments, castings and forgings are being stress-relieved. Stress-relief is so thorough that subsequent machining is more accurate — and all these advantages are being attained in an automatically-controlled annealing cycle which is shorter than a manually-controlled one.

Reason for this success is that the Micromax Control Pyrometer strikes at the cause of distortion—which is, of course, the difference in expansion rates of the different sections of the structure. Micromax does this by using two thermocouples. One is tack-welded to the surface of a thin-sectioned element; the other to a thick-sectioned element. As the structure heats, Micromax measures the difference between the temperatures of the two sections, and when the thin one has run ahead by a predetermined value — down goes the fuel, until the thick section catches up.

On the cooling cycle the operation is reversed; Micromax operates furnace dampers to speed up or slow down the cooling rate and prevent stressing the structure.

Thus the weldment itself sets its own rate of heating and cooling, subject to the heat-treater's okay; the forces which cause stress are removed; heating proceeds at the ideally correct speed. And this speed, being based on actual measurement, is faster than a good workman could permit without the measurement, for his judgment would lead him to play safe by setting a slower rate.

This Micromax also relieves the heat-treater of holding the heating cycle, for it is a Program Controller. It compels the furnace to heat at a preset rate or rates, to soak for a preset time; to cool at a preset rate or rates. It handles temperature with the *dependability* so important in all manufacture of munitions and supplies.

If you have a specific problem, outline it and we will send specific recommendations, or we will send a catalog on request.

Jel ad N-33A-626(3)

ARMY ★ NAVY

depends on me!

A Slogan For Every American

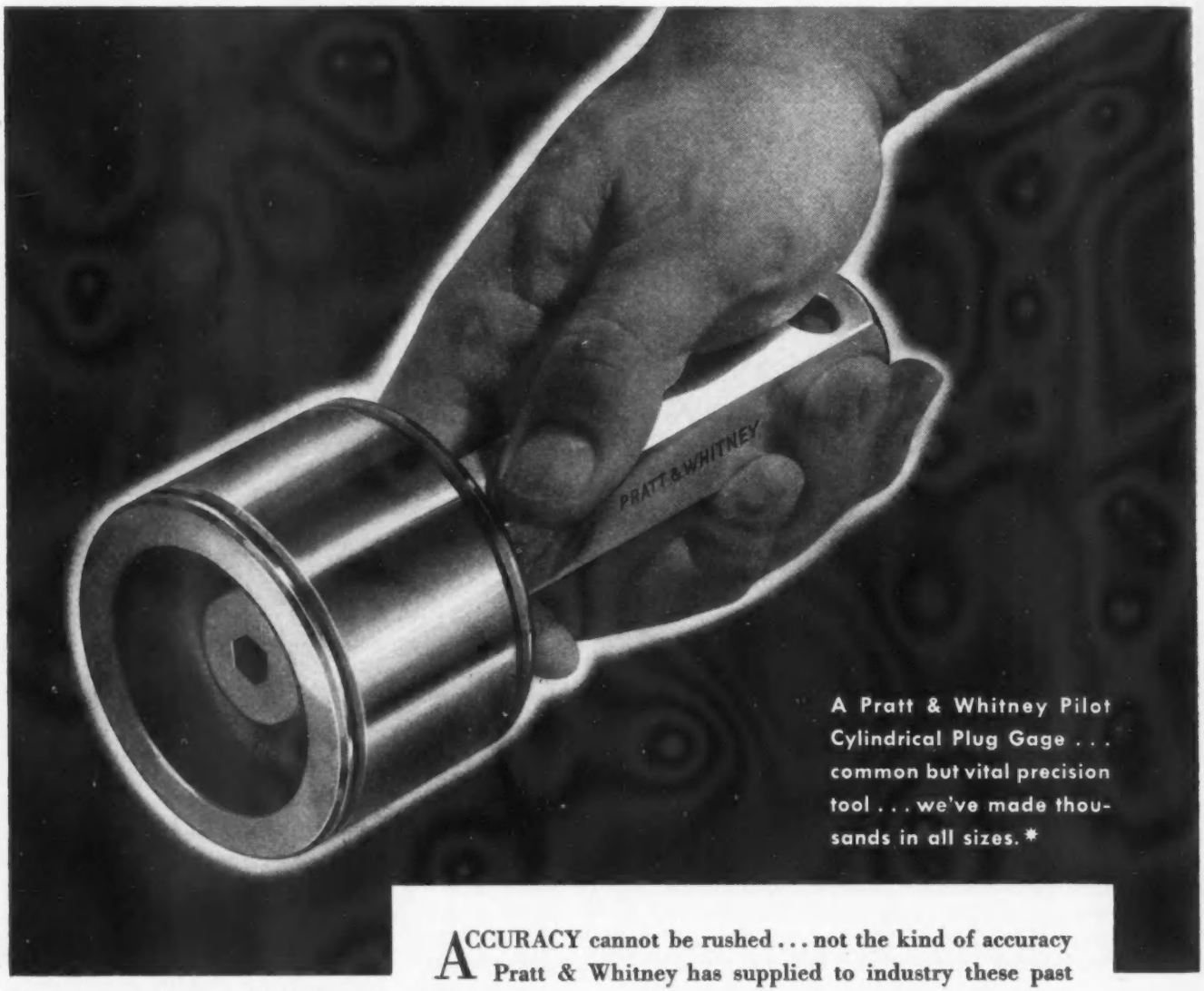
LEEDS & NORTHRUP COMPANY, 4966 STENTON AVE., PHILA. 44, PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

THROUGH ALL THE RUSH

One Standard that has never changed



A Pratt & Whitney Pilot Cylindrical Plug Gage . . . common but vital precision tool . . . we've made thousands in all sizes.*

ACCURACY cannot be rushed . . . not the kind of accuracy Pratt & Whitney has supplied to industry these past 83 years.

We know full well the desperate pressure and rush of war production . . . we've served faithfully through many of our country's wars. But never in any of these emergencies has the Pratt & Whitney standard of accuracy been sacrificed for speed. Enlarge our facilities . . . yes. Add and train thousands more men . . . yes. But lower our standard of accuracy . . . never. Through peace and war, Pratt & Whitney machine tools, small tools, and gages are made to one rigid standard of accuracy which has never changed.

*Many of our customers waive their own inspection of new Pratt & Whitney Cylindrical Plug Gages . . . an expression of complete confidence that regardless of war pressure, we will continue to produce only gages of trustworthy precision.

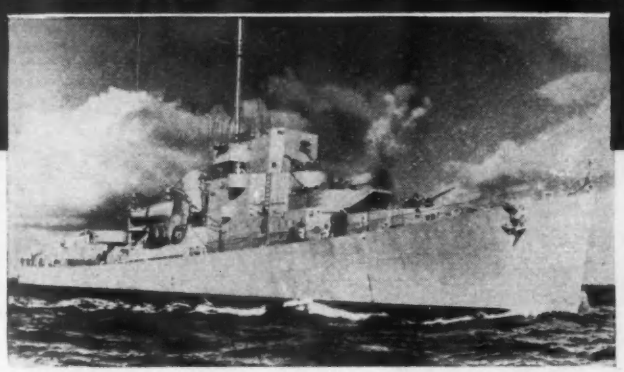
PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD • CONNECTICUT

"Tin Cans" need

PORUS ★ KROME*



Official U. S. Navy Photograph

Destroyer escorts . . . like the "Tin Can" here . . . need, and are getting, the dependability and long life of PORUS-KROME on the cylinder liners of their main Diesel engines.

Destroyer escorts dart speedily in and out, and around, protecting and shepherding the convoys. These bursts of speed in addition to the long trips are cruel punishment for the main Diesel engines, particularly the cylinder liners.

The Navy specifies PORUS-KROME in the cylinders of its Diesel engines for destroyer escorts, submarines and mine sweepers . . . more than 2,000 engines with PORUS-KROME now in service . . . more than 300 per month being added.

PORUS-KROME was discovered and the process patented by Van der Horst. The first Diesel CYLINDER liners for the Navy were processed in 1939. Now, three Van der Horst plants are producing PORUS-KROME for the Navy, Army and Air Force for the engines of today, and are ready to plan for the engines of tomorrow

May we tell you more about this time-proved product and its application to your engines?

*PORUS-KROME is hard chromium applied by a patented, precision process that develops pores to hold oil. Used on internal combustion engine cylinder bores, piston rings and other bearing surfaces, it reduces wear, corrosion and scuffing, greatly multiplying engine life.

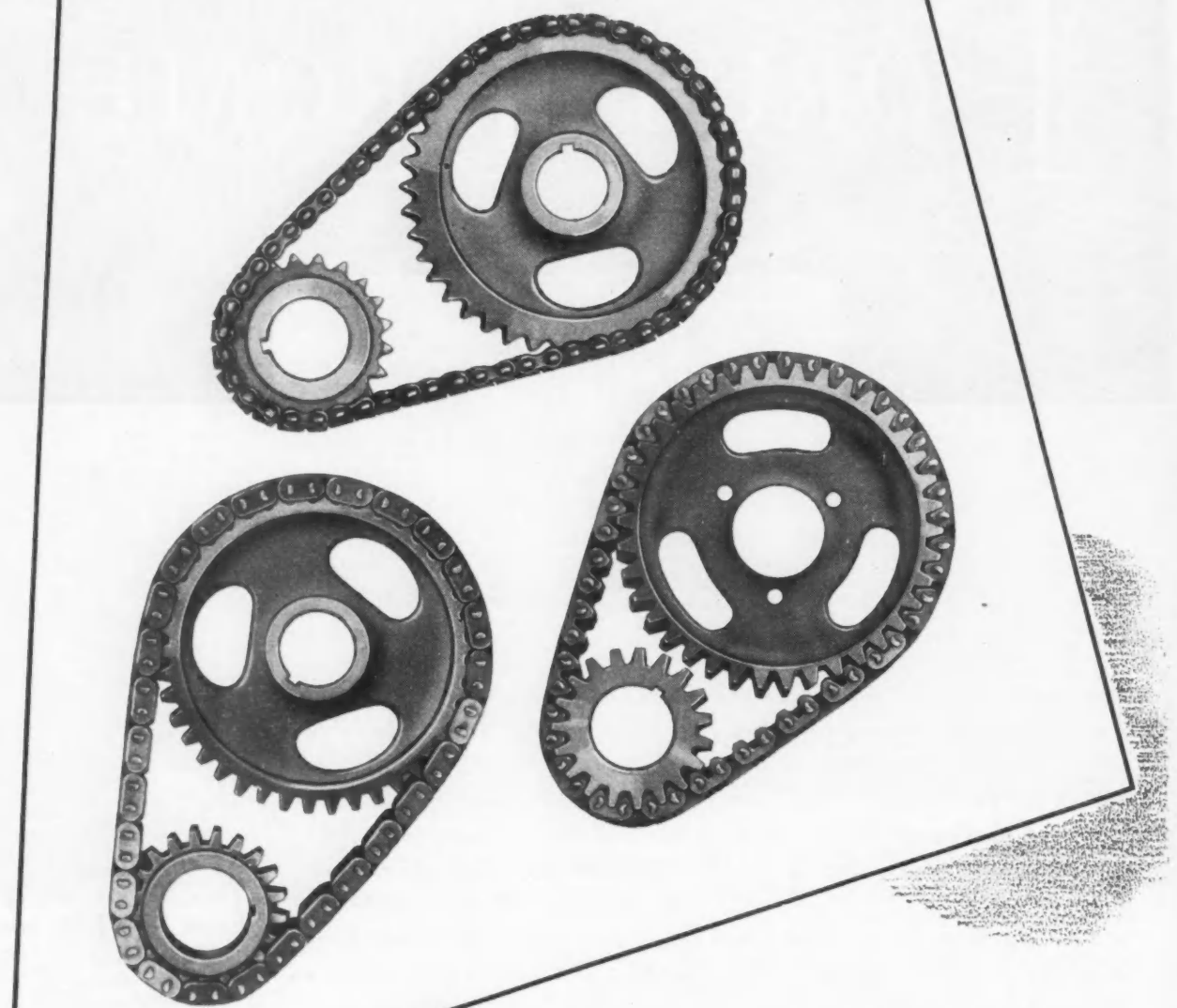
VAN DER HORST
TRADE MARK

PORUS ★ KROME

Multiplies Engine Life

VAN DER HORST CORPORATION OF AMERICA CLEVELAND, O. OLEAN, N. Y.

MORSE panel for the future



TOMORROW, because of research done today, Morse will again make better timing chains available to peacetime manufacturers. Working in close cooperation with automotive engineers, since the dawn of the automotive era, Morse is best equipped to equip you with better timing chains—to work with you on the development of special timing chains for new or special applications.

SPROCKETS CHAINS FLEXIBLE COUPLINGS CLUTCHES

MORSE Roller and Silent CHAINS

MORSE CHAIN COMPANY • ITHACA, N. Y. • DETROIT, MICH. • A BORG-WARNER INDUSTRY

When writing to advertisers please mention AUTOMOTIVE *and* AVIATION INDUSTRIES

Who can use this after the war?

So far this is definitely a war baby. It was born to meet an exacting wartime need. Every one that is made goes right into the fight.

It is an electric motor designed for jobs which no regular electric motor could fill.

The jobs are on America's fighting planes. Working control flaps—opening and closing cooling shutters—lifting landing gears—and the like.

Every ounce on an airplane is precious. So usual electric motors were out.

This one weighs as little as 8/10ths of a pound—others can move as much as 35 tons.

Naturally it took a whole new kind of engineering to make this motor.

It took new ideas from the drawing board up. It took new materials—like glass-insulated wire—to build it. It required finer, more precise craftsmanship than had ever gone into a motor before.

After the war, these motors can be sold to manufacturers of peacetime products.

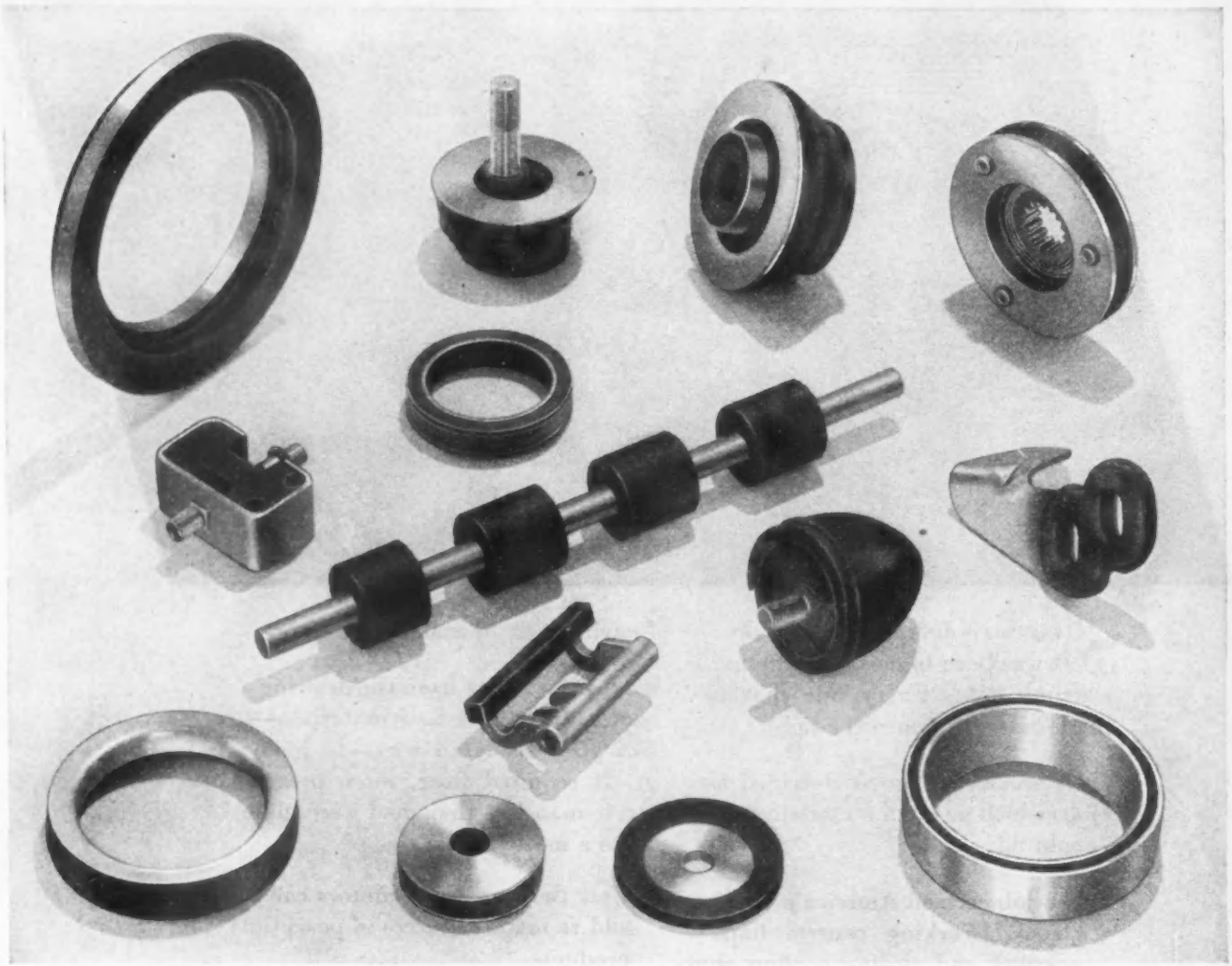
That is why we are telling you about them now.

You may have need for such a compact, ultra-efficient source of power. You may be able to use the kind of engineering thinking that developed it—or the production technique that builds it and about 250 other Lear products.

PLANTS: Piqua, O., and Grand Rapids, Mich. BRANCHES AT: New York, Los Angeles, Chicago, Detroit, Cleveland, Providence.

LEAR AVIA INC.
PIQUA · OHIO

WHEN RUBBER AND METAL MUST WORK TOGETHER



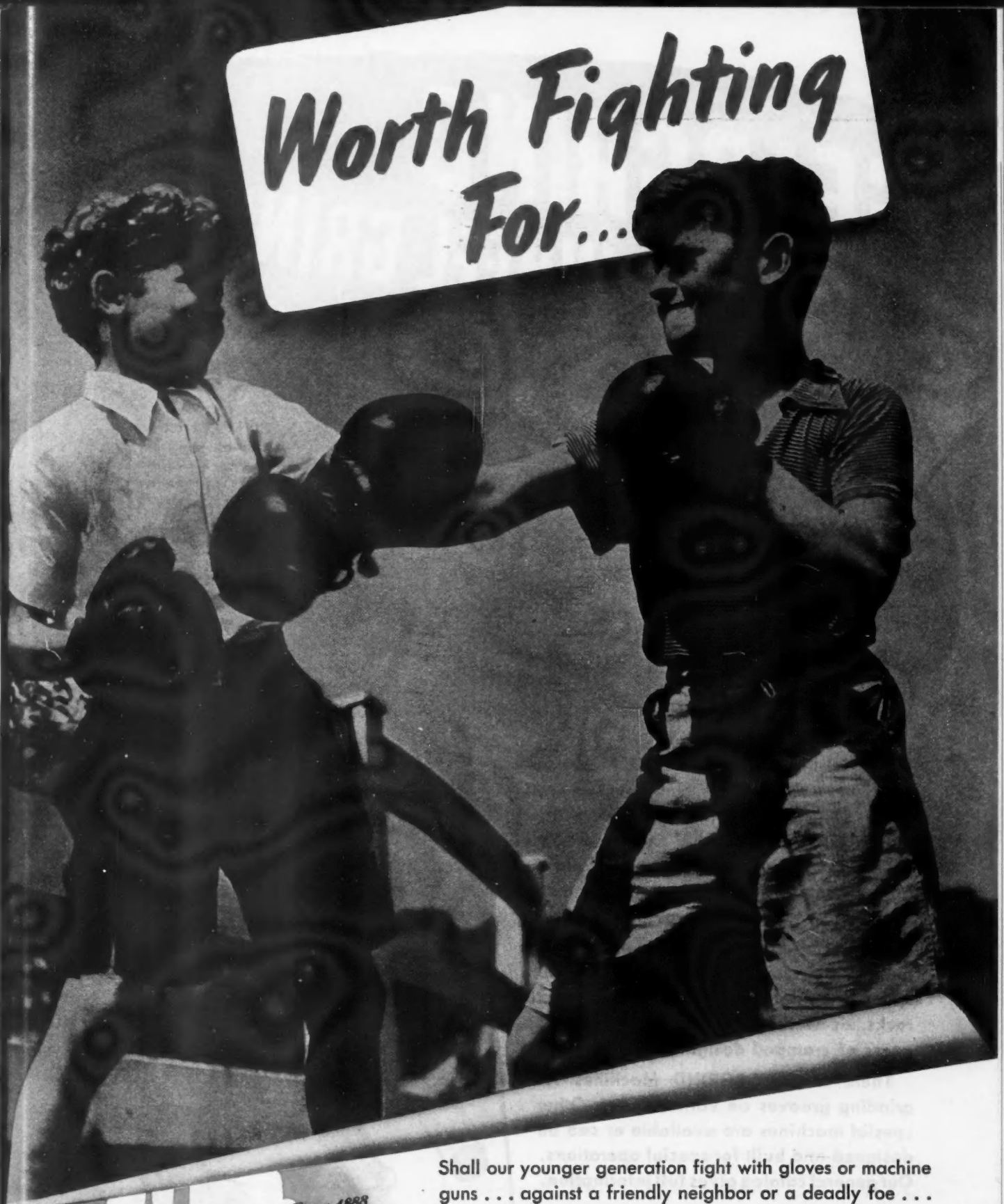
Rubber and synthetic rubber work with metal in countless ways . . . to control vibration . . . to minimize friction . . . to absorb stresses and strains . . . to eliminate metal to metal contacts wherever metal must be protected against itself. Vital to the success of rubber, or synthetic rubber-to-metal adhesion parts are the bonding processes as perfected by The Ohio Rubber Company. Here, too, you will find the organization and facilities qualified to meet your needs for molded (hard or soft) and extruded rubber and synthetic rubber parts or complete products. In a word, we offer you "ORCO-OPERATION".

Call

OHIO RUBBER CO

"ORCO-OPERATION"

THE OHIO RUBBER COMPANY · WILLOUGHBY, OHIO



Precision Built Milling Machines Since 1888

KEMPSMITH

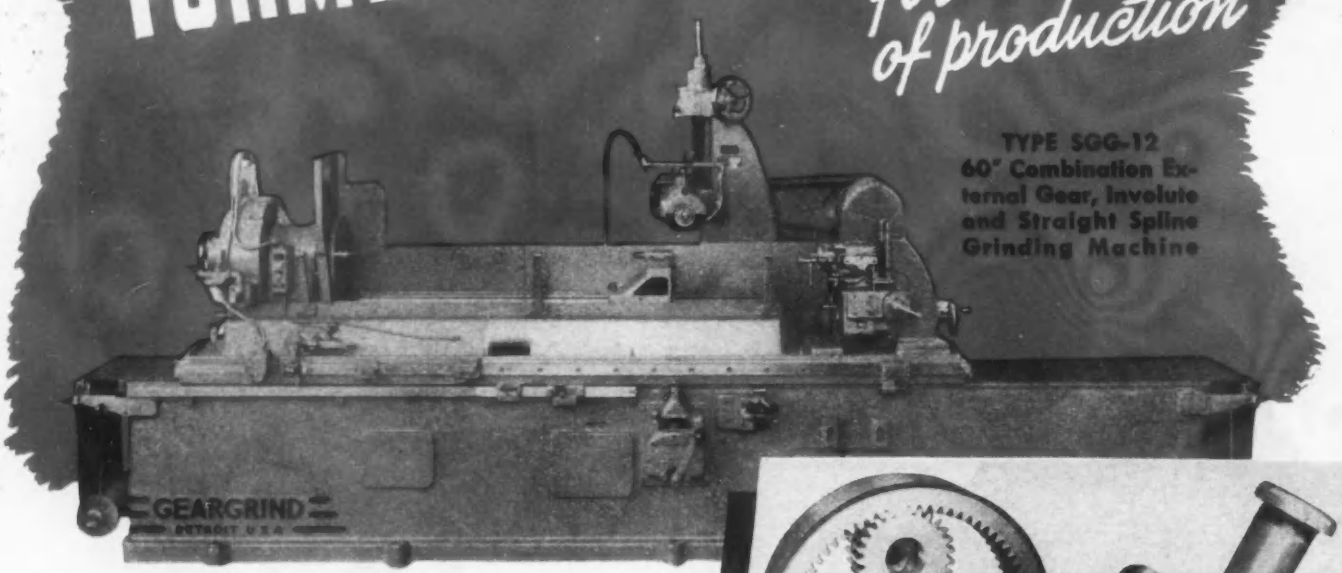
KEMPSMITH MACHINE COMPANY • MILWAUKEE 14, WIS., U. S. A.

Shall our younger generation fight with gloves or machine guns . . . against a friendly neighbor or a deadly foe . . . in peaceful, back-yard surroundings or in blood-drenched battle fields? The answer depends on what YOU and I do on the production front. We must CONTINUE to produce vitally needed war equipment and supplies . . . in ever increasing amounts . . . to help the United Nations win the War. We dare not let them down. We must

STAY ON THE JOB!

GEARGRIND FORMED WHEEL GRINDING

for all types of production



TYPE SGG-12
60" Combination External Gear, Involute and Straight Spline Grinding Machine

In the tool room GEARGRIND Machines are grinding master gears, involute or straight sided spline gages and spline work arbors, plug gages for involute, V shaped or straight sided keys, many types of punches and dies, and master index plates.

On production runs, GEARGRIND Machines are doing magnificent work on external and internal gears, external and internal involute splines, straight splines, serrations and racks, as well as cluster gears and other gears of cramped design.

There are GEARGRIND Machines for grinding grooves on variable arcs. Other special machines are available or can be designed and built for special operations. Our general catalog gives full information.

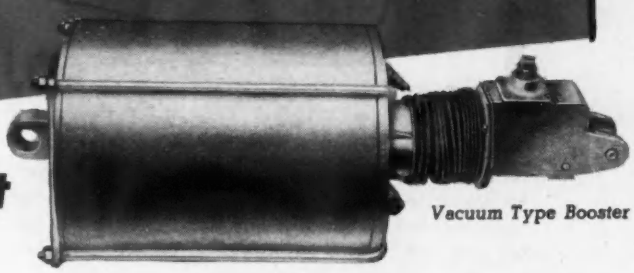
The GEAR GRINDING MACHINE COMPANY
DETROIT 11 MICH. U.S.A.

ARMY E NAVY

EMPIRE announces

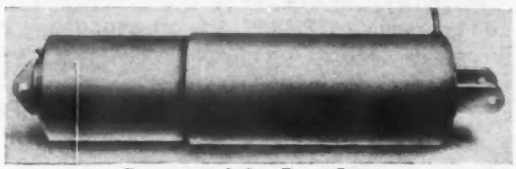
POWER STEERING AND STABILIZING

with this simple unit



Vacuum Type Booster

This new Empire Steering Booster makes a truck steer with the *ease* and *safety* of a passenger car. A simple, self-contained unit, with a single connection to the steering gear, it is actuated by vacuum from the intake manifold or by air from a compressor. Either type can be furnished with no limitation on size, so that Power Steering may be applied to the largest truck or bus.



Compressed Air Type Booster

The unit also acts as a stabilizer, and not only is it a protection against oversteering, but it also tends to eliminate road shocks, shimmying, wandering and wheel fight.

The Empire Steering Booster is so designed that it can easily be made an integral part of any new truck or bus. Complete kits will be available for installation on trucks already in service.

WRITE FOR DESCRIPTIVE BULLETIN

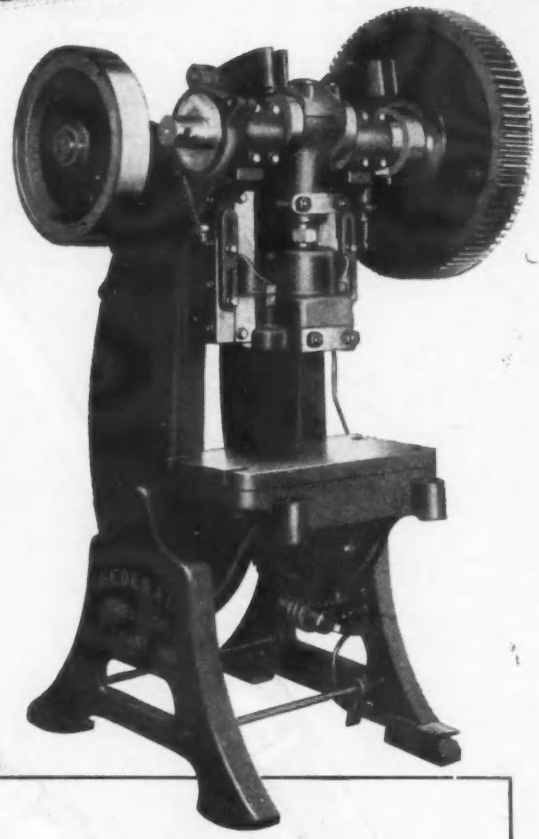
ELECTRIC EMPIRE BRAKE CO.

South 14th Street Newark 7, New Jersey

Manufacturers of **MAGDRAULIC ELECTRIC BRAKE • VACDRAULIC BRAKE POWER BOOSTER AND EMPIRE STEERING BOOSTER AND STABILIZER**

17

THIS STANDARD PRESS DOES SPECIAL JOBS



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By welding layers of steel to the worn wheel, then machining this "retread" to the standard tire contour, badly worn locomotive tires—and axles too—can be reclaimed.

Wartime steel shortages, and the pressing need to keep equipment running, has greatly increased the need for this maintenance service.

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Motor.... Specifications optional

...on cut-off jobs!

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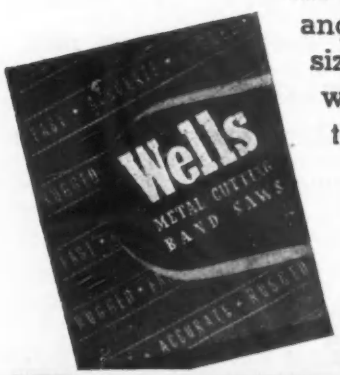

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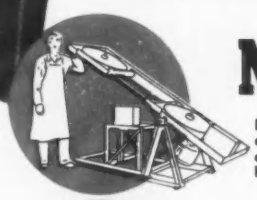

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General Foundry Saw.

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Heavy duty production Saw.

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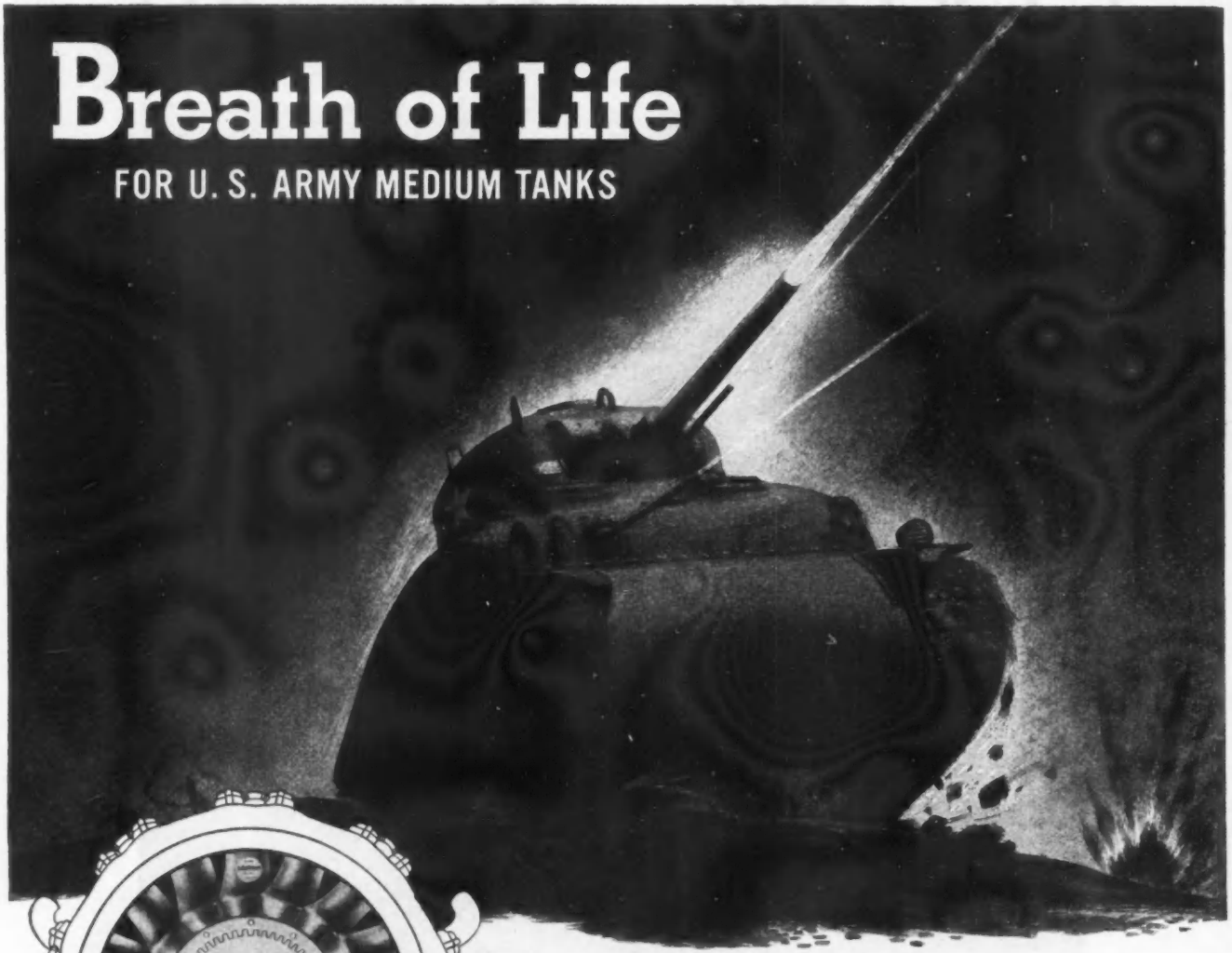
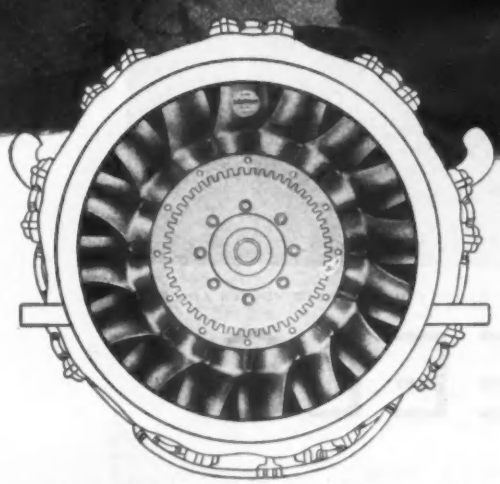




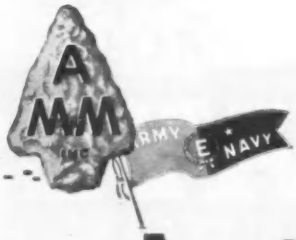
34" DEBOTHEZAT FAN FOR COOLING air-cooled aircraft type tank engines.

BURY A BIG, air-cooled radial aircraft engine in an armored compartment not much bigger than its crate . . . and you have one of the toughest blast-cooling problems imaginable.

To make the problem tougher, cooling air must be brought in through small inlets with armored gratings and into the fan at a *right angle* to the axis of its blades.

DeBothezat engineers produced the answer by designing a new fan with a laminar flow profile. Although made of steel, die-formed and welded, it weighed no more than the cast aluminum fan wheel which it replaced. Best of all, this new fan reduced engine temperatures by many degrees thereby eliminating the hazards of overheating and consequent stalling . . . an important factor in desert warfare.

DeBothezat's modern aero-dynamic laboratories are ably staffed with skilled technicians experienced in solving numerous difficult engine cooling problems.



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HE MAKES ?

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Gages often must be accurate to within infinitesimal tolerance limits—a very few millionths of an inch. These "millionths" must be measured accurately.

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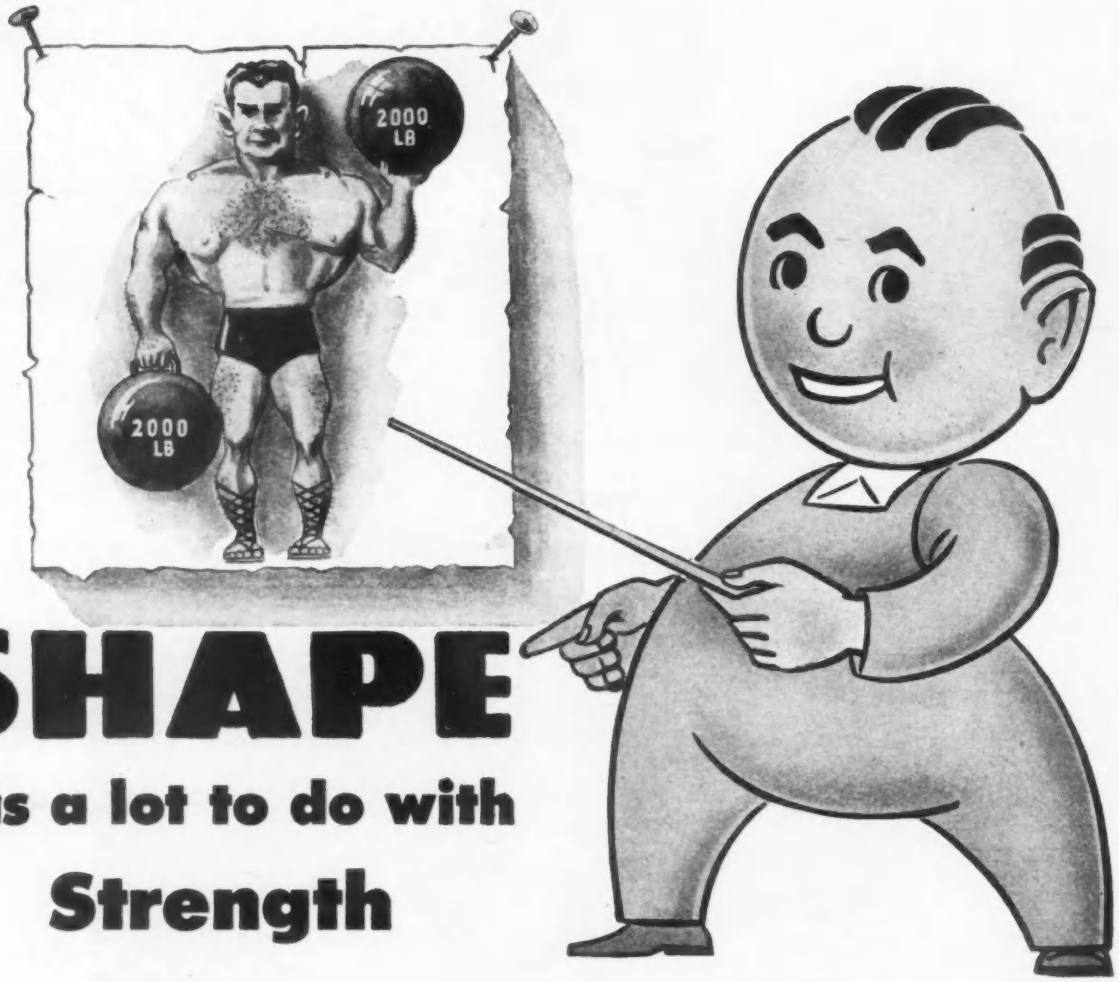

SHAPE
has a lot to do with Strength

Every time you start a load, or shift gears, the engine's torque is applied directly to the transmission. The teeth in the gears must be able to withstand not only extreme pressure, but often a series of shock loads. Naturally, correct gear ratios help, but Fuller has gone further than this. Through design research and test, it was found that sturdier strength could be added to the individual gear teeth by a change in their shape. That's why the teeth in Fuller gears are different from ordinary gears—more resistant to shock and strain. It's another reason why Fuller transmissions have these well recognized characteristics: (1) Quiet running (2) Easy shifting (3) Longer wear life.

FULLER MANUFACTURING COMPANY, KALAMAZOO, MICHIGAN
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KEEPING AMERICA STRONG

America owes no small debt of gratitude if not its very sustenance to countless thousands of nocturnal messengers . . . those carriers of the nation's milk supply ★ Piercing the hinterland, whisking over broad highways, these harbingers of health present one of the world's most diversified operations. Safety, dependability, and economy . . . watchwords of the industry, naturally call for highly specialized, well balanced equipment. That Bendix-Westinghouse Air Brakes have found universal favor as standard equipment among the leaders in this vital industry is high compliment indeed, but not without merit ★ Bendix-Westinghouse has for years worked closely with the Milk Cartage Industry. Its engineers have studied and perfected Brakes and Pneumatic Controls which have later served conspicuously in other fields of transportation. In view of the intimate role it has been privileged to play in the evolution and current perfection of this vast industry, Bendix-Westinghouse takes particular pride in its ability to continue its research and serve with the recognized leaders in this and allied fields ★ Quite possibly your control problem deserves this same engineering touch which is yours without obligation. May we suggest you contact your local Bendix-Westinghouse Distributor or write direct to the manufacturer for complete information?

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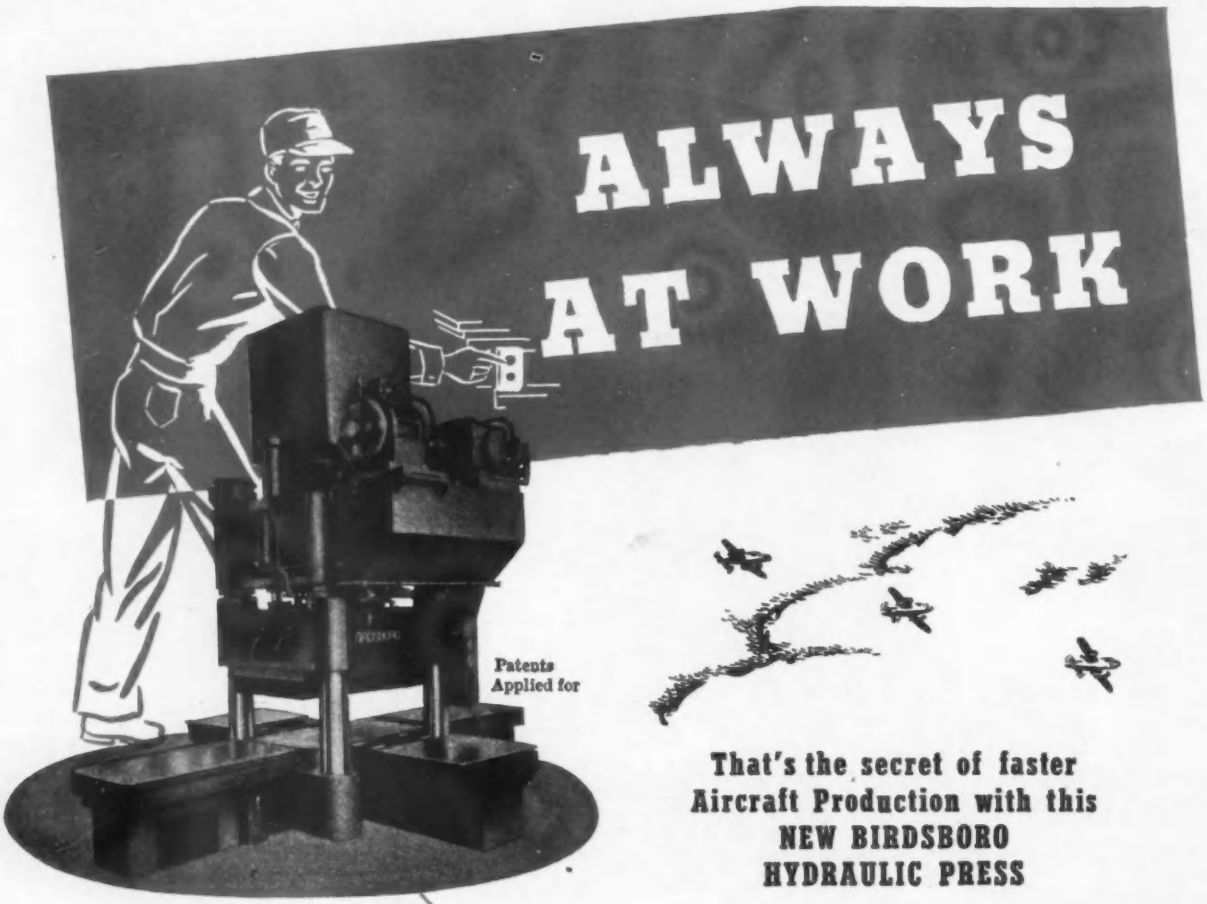


That's the secret of faster Aircraft Production with this NEW BIRDSBORO HYDRAULIC PRESS

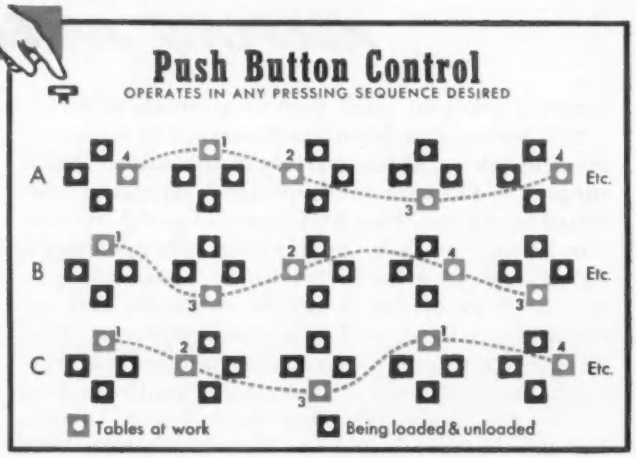
Major improvements in hydraulic press design don't occur often. But when one does, it's news—BIG news.

For instance, the exclusive automatic Shuttle Table arrangement Birdsboro engineers recently developed for use with Birdsboro Hydraulic Presses, transfers work along the *shortest* possible line, a *straight* line between loading and pressing position. Four conveniently arranged Shuttle Tables, fully synchronized with the pressing operation can be moved in any sequence selected by the operators by pushing respective control buttons in whatever order they desire.

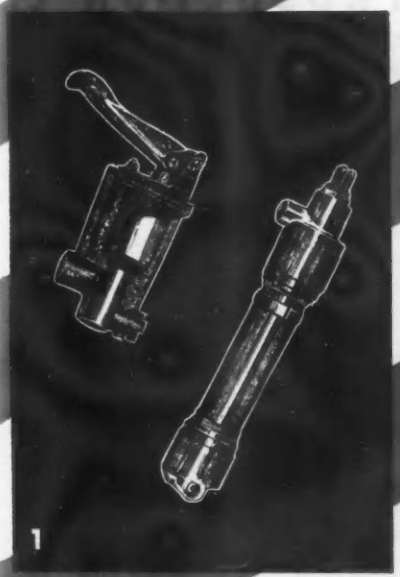
As a result, the press is always operating with *one of the four shuttle tables.* No press time is lost waiting for loading. Hence, faster work, greater production and a minimum of strain on the operators.

BIRDSBORO STEEL FOUNDRY AND MACHINE CO.,
BIRDSBORO, PA.

Birdsboro's advances in hydraulic press design have come as a result of Birdsboro's engineers applying their specialized knowledge to the specific problems of the customers they serve. If you have a press problem, let Birdsboro engineers work with you for a speedy and satisfactory solution.



BIRDSBORO
HYDRAULIC PRESSES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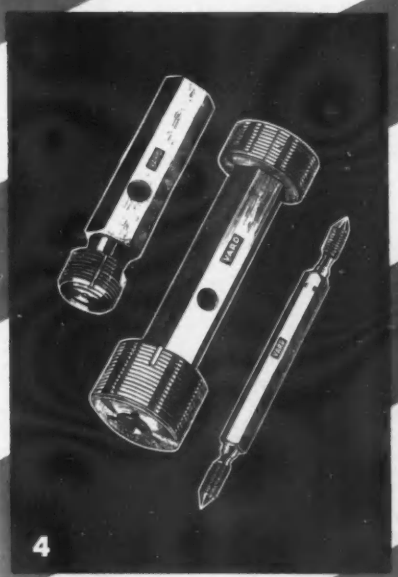
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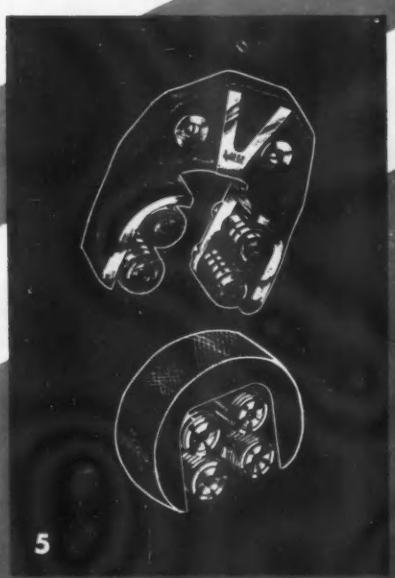
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-IN '44

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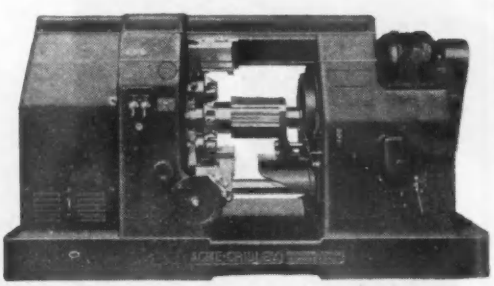

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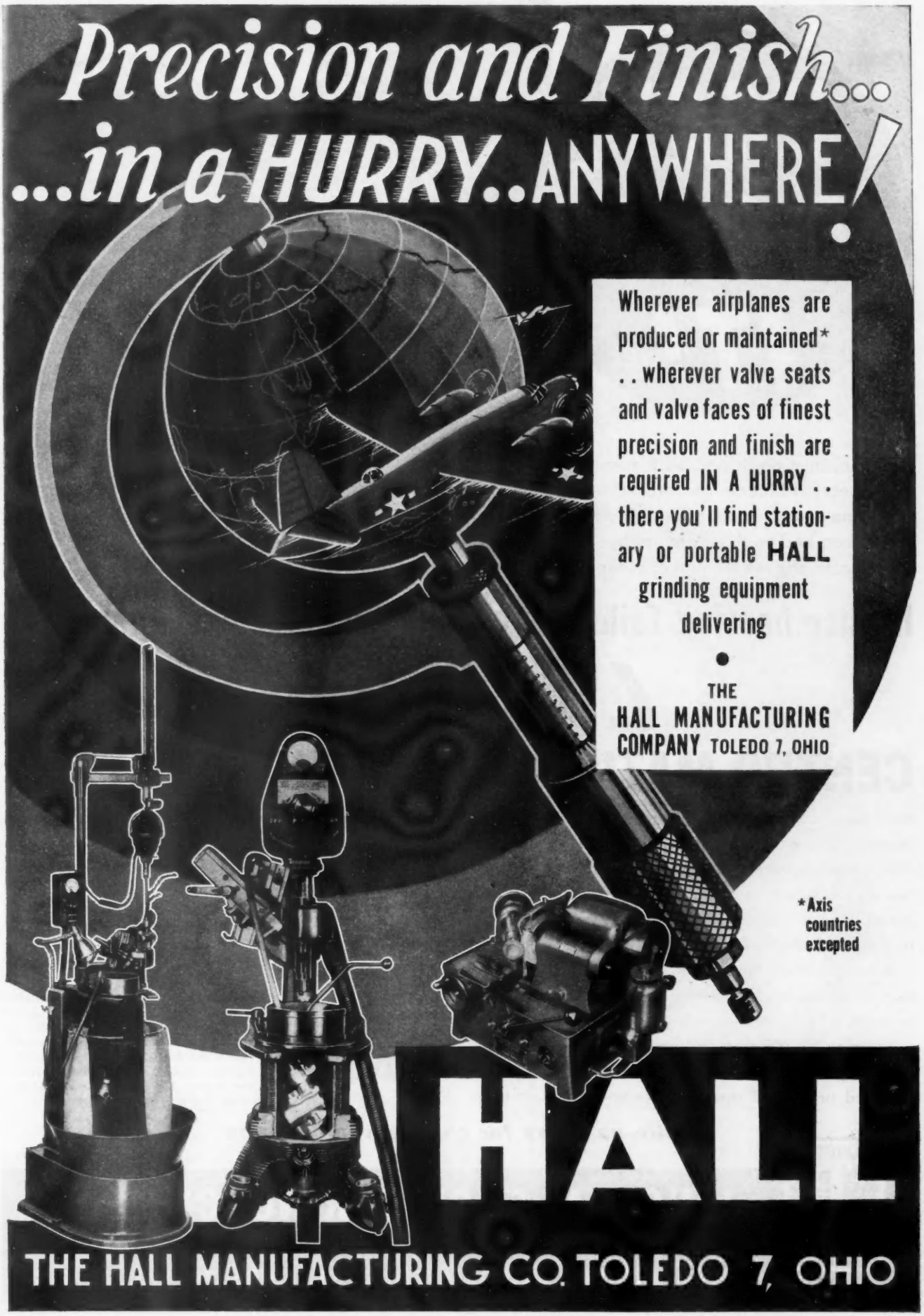

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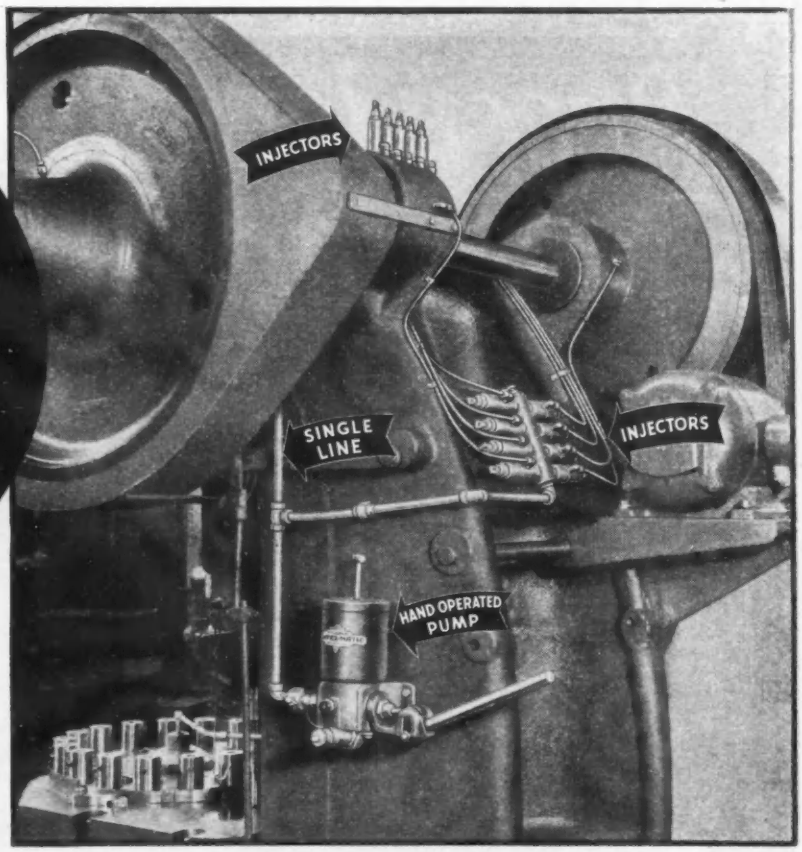

On machines equipped with manually operated Lincoln centralized lubrication system—*just a few strokes of a lever,* and each and every bearing gets the proper amount of grease.

Reduce bearing failures by equipping your machinery with

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CENTRO-MATIC LUBRICATING SYSTEMS

Save time... Save effort... Save manpower... Reduce bearing failures . . . Eliminate the need for shutting down production line machinery in order to lubricate bearings requiring grease lubrication. It's possible when machines are equipped with the Lincoln modern method of *centralized* lubrication.

A Centro-Matic System makes it possible for one man to lubricate *all* bearings in a fraction of the time it would take to contact each individual bearing.

A Centro-Matic System consists of a number of Centro-Matic Injectors—one for each bearing—and a power operated or a hand operated Centro-Matic Lubricant Pump. A power operated system can be either time clock control or push button control . . . The injectors can be grouped in manifold or located separately at each bearing In either arrangement only a single lubricant supply line is required . . . Can be easily installed on new or old machines.

The ARMY-NAVY PRODUCTION AWARD for high achievement in the production of war equipment, conferred upon the Lincoln Engineering Company has had two stars added. Each of these stars symbolizes 6 additional months of exacting service to our Armed Forces, delivering vital materials so necessary for ultimate Victory.

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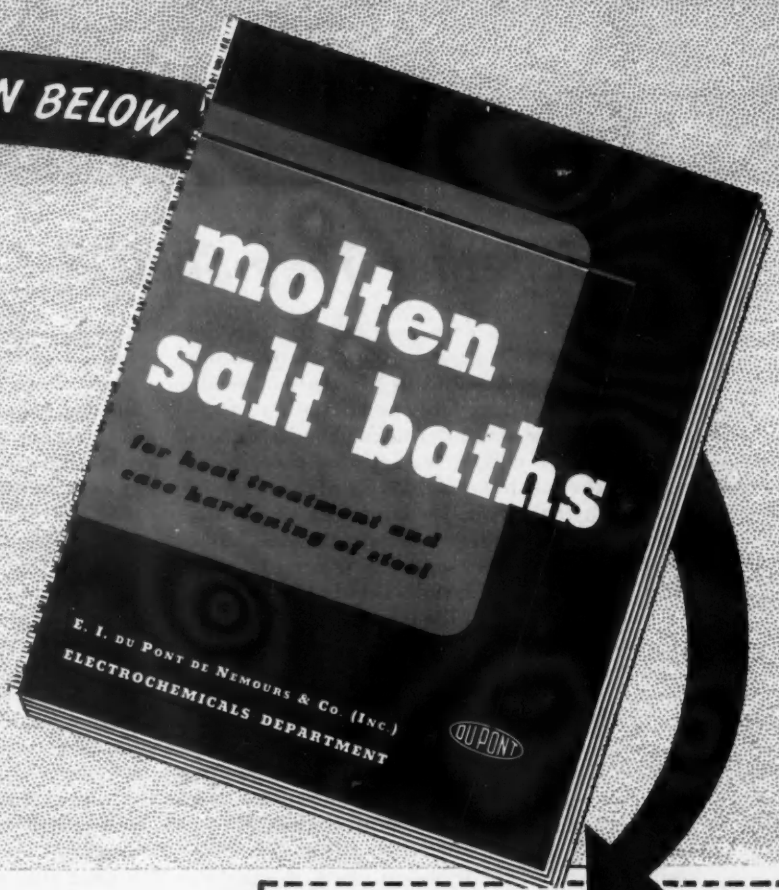
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for heat treatment and case hardening of steel
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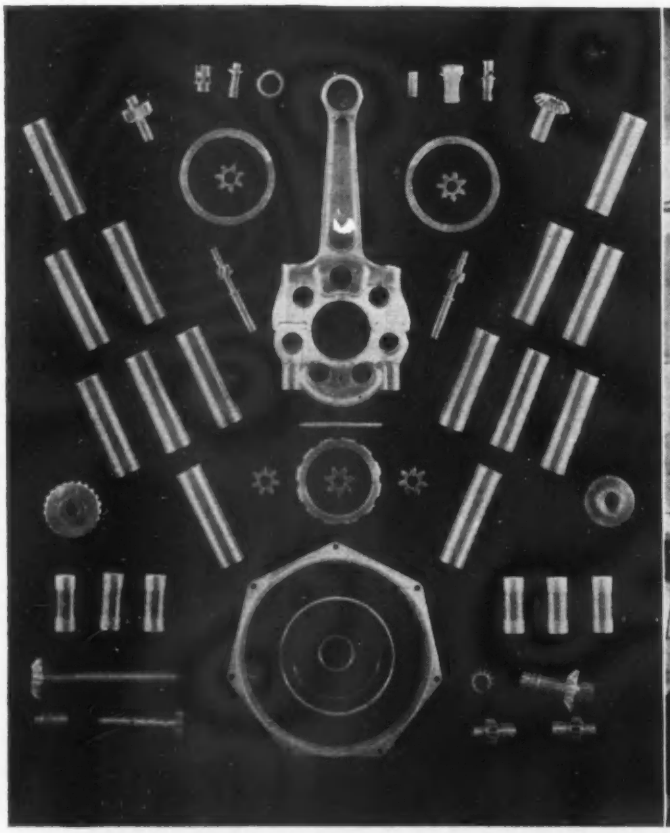
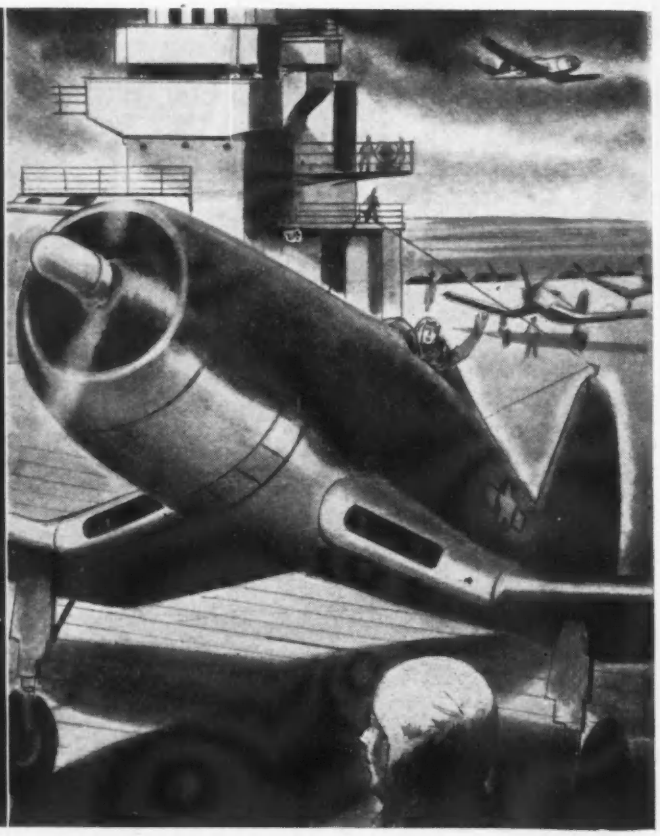




Together They Spell V-I-C-T-O-R-Y

LOOK OVER THE EDGE of a carrier's flat top, or stand on the side of a jungle clearing when the incisive, urgent demand to *"Scramble!"* sends the world's finest pilots into the cockpits of Corsairs, Hellcats, or Thunderbolts. You'll understand why it goes without saying that every pilot appreciates the mechanical marvels of these battle planes. Catch that grim, yet confident smile that touches their lips as they "pour on the coal" and "rev" up their 2000 horsepower Wasps. It's the acid test. And as those daredevil kids hit the blue with a nonchalant flip of the mitt, you feel that the greatest support to their courage is their confidence in the caliber of craftsmanship which made the power plants in their planes possible.

An aircraft engine manufacturer must be master of the infinite. Exquisite precision in all manufacturing and assembly operations must ever be his goal—for the challenge in making an engine like the 2000 horsepower Double Wasp is this . . . to preserve . . . by delicate accuracy of manufacture and finish . . . all of the inherent strength and endurance in every ounce of material used. This need for perfection is not new to McAleer. For years it has been our special province to develop materials and methods for finishing metals with precision and lapidarian skill. In today's tasks we are benefitted by all that 18 years of manufacturing experience in the development of *quality-controlled* finishing materials and job-proven finishing methods has to offer. These facilities we gladly place at your disposal.

Because this company makes buffing, polishing and burring compositions in the broadest range, we are qualified to offer you unbiased advice and to formulate the most desirable type of finishing material required to handle your specific job.

Your war-time finishing problem may not be as tough as that presented by the finishing requirements of the above aircraft engine parts where the micron finish had to meet the toughest of Army and Navy specifications—then again, in its own way, depending on the job to be done, whether that job involved the polishing or buffing of aluminum, brass, steel, copper, nickel, chrome and other metals, or even plastics—it may be tougher to lick. In any event if it's got you stumped—we'd like a try at it. We'll let results speak for themselves! It is our privilege to continue to work closely with many of America's leading War Materiel producers—they, you and we have but one job to do until victory is won. *Let's get on with it!*

McAleer MANUFACTURING CO.

Manufacturers of Quality-Controlled Finishing Materials, Military Aircraft Sub-assemblies and Pyrotechnics : : :

ROCHESTER, MICHIGAN

VIBRATION A PROBLEM?

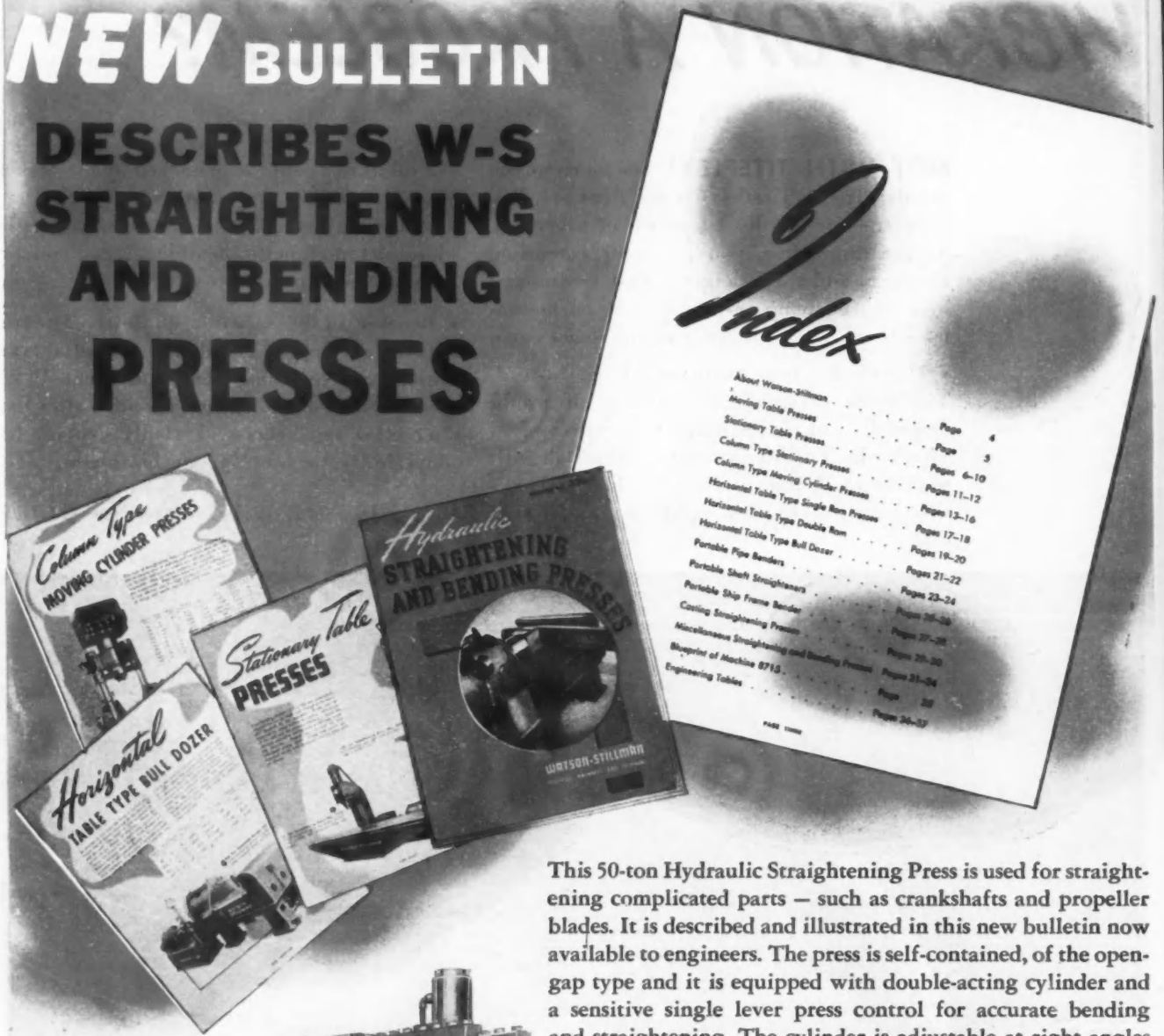
NOT WITH TITEFLEX! The moment you standardize on Titeflex flexible lines you lick once and for all the bug-a-boo of vibration. At the same time, you overcome corrosion, abrasion, and the headaches that accompany high engine temperatures. And your customers thank you—for lower maintenance costs.

• For Titeflex is no ordinary tubing. Instead, Titeflex is designed as you yourself would design it — to do the work you expect of it. That's why Titeflex is metal — *all* metal, with nothing to disintegrate or "go bad." That's why *all-metal* Titeflex, unlike any other fuel and oil lines, cannot be damaged by the action of gasoline or oil. And that's why Titeflex has long been a "must" with automotive people who insist upon better flexible oil, gas, and air lines at lower, overall costs.

• Because of its superior qualities, Titeflex is today serving its country on essential war vehicles and on home-front equipment. Will it be serving you and your customers after the war? Our engineers will gladly explain its adaptability to your specific problems.

TITEFLEX, INC., 507 Frelinghuysen Ave., Newark 5, N. J.

NEW BULLETIN DESCRIBES W-S STRAIGHTENING AND BENDING PRESSES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Stationary Table PRESSES
Horizontal TABLE TYPE BULL DOZER
Hydraulic STRAIGHTENING AND BENDING PRESSES
WATSON-STILLMAN

This 50-ton Hydraulic Straightening Press is used for straightening complicated parts — such as crankshafts and propeller blades. It is described and illustrated in this new bulletin now available to engineers. The press is self-contained, of the open-gap type and it is equipped with double-acting cylinder and a sensitive single lever press control for accurate bending and straightening. The cylinder is adjustable at right angles to the table movement, making it possible to apply the pressure on any point of the table. Work table is movable along bed of machine by means of hand-wheel, permitting accurate location of heavy pieces under the ram without moving the work. The Watson-Stillman Co., Roselle, N. J.

This 50-ton Straightening Press provides a 24 in. stroke, with ram 7 in. in diameter, exerting a pressure of 2750 lb. per sq. in. The machine is 35 in. wide, 12 ft. long. The bed measures 12 ft. by 35 in.

Ask for your copy of Bulletin No. 320-A
It contains information and technical data on Moving Table Presses • Stationary Table Presses • Column Type Stationary Presses • Column Type Moving Cylinder Presses • Horizontal Table Type Single and Double Ram Presses • Horizontal Table Type Bull Dozers • Portable Pipe Benders • Portable Shaft Straightener • Portable Ship Frame Bender • Casting Straightening Presses • Specifications and Engineering Tables for all types are included.

WATSON-STILLMAN

Designers and Manufacturers of Hydraulic Equipment, Forged Steel Fittings, and Valves.

5851

VICTORY IS MADE UP OF *Little things*

THE struggle for final victory, just as quickly as it can be accomplished, is the first and foremost concern of all of us at this moment. It is a hard, grim business which must be cleaned up before we may renew interrupted relations and turn to more pleasant tasks.

Final victory is made up of many component parts—many of them relatively small compared to the overall effort, yet none the less vital to the success of the effort.

Mechanized war equipment is dependent upon adequate and effective protection for the various bearings involved in it—safeguarding which keeps out dirt, dust, grime, water, and keeps in the life giving lubricant. We are working 100% to provide Milpaco Oil Seals to do this important job.

In spite of all the efforts we are making and all of the expansion of facilities in our plant, we are unable, at the moment, to supply Milpaco Oil Seals to all of our old customers. We are greatly concerned over this situation but find ourselves unable to relieve it. We ask you to bear with us and assure you of our desire to supply you with Milpaco Oil Seals again just as soon as possible.

Mechanized Equipment provided with Milpaco Oil Seals for Bearing Protection includes

JEEPS

TRUCKS

TANKS

MILPACO *Oil Seals*

MICHIGAN LEATHER PRODUCTS COMPANY

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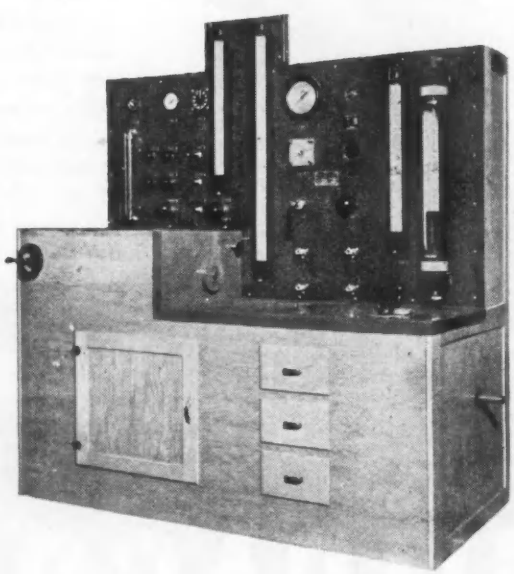
BACK THE ATTACK-- IT DRIVES THEM BACK
EXTRA DOWN
FOURTH WAR LOAN
FREE ENLARGEMENTS (14" wide) of this cartoon by Edmund Duffy, twice winner of the Pulitzer Prize, are available. Write, on your business letterhead, to: Bruce Livie, President, Liberty Motors & Engineering Corp., Baltimore-1, Md.
Copyright 1944, Liberty Motors & Eng. Corp.

For Complete, Accurate Tests of Aircraft Pumps of All Types · · · Vacuum and Hydraulic

This Liberty Test Unit (Type 111) checks both vacuum and hydraulic pumps at speeds from 700 to 5200 R.P.M. For Vacuum Pumps, input suction and output pressure are shown directly in inches of mercury; air flow may be read from 0 to 50 c.f.m. For Hydraulic Pumps, input suction is shown in inches of mercury; output pressure on a 0-to-4000 p.s.i. pressure gauge. Flowmeter reads from 1.5 to 12 g.p.m. hydraulic fluid. This Liberty test bench is ideal for permanent bases, rear echelon repair, check-ups, and for plane builders. Write for complete information.



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& ENGINEERING CORPORATION
BALTIMORE-1, MARYLAND

MANUFACTURERS OF AIRCRAFT SERVICE TOOLS AND TEST EQUIPMENT

A new approach

TO FINISHING

RIGHT NOW important developments definitely indicate a complete new approach in the field of finishing . . .

Experimental projects designed to increase the *solids content* of nitrocellulose formulations show promise of success. This will reduce the number of coats necessary—*sharply cut the over-all cost of finishing.*

Furthermore, and this is especially interesting to manufacturers "changing over" or developing new products . . . nitrocellulose lacquers *air dry* in minutes, do not require the installation of expensive baking or drying equipment.

Yes, there are many reasons why many finishers are awaiting the coming events in nitrocellulose lacquer. Keep in touch with your lacquer supplier.

THE IDEAL POSTWAR PROTECTIVE FINISH

- Dries in air in a matter of minutes —no drying equipment necessary.
- Unmatched in color possibilities.
- Tough, brilliant, durable, flexible, resistant to water and chemicals.
- Easy to apply—on wooden or metal surfaces—by spraying, dipping, tumbling, or roller-coating.
- Permits easy repairing of mars and scratches incurred in handling after finishing.

Hercules makes no finished lacquers, but concentrates entirely on the production of high-quality nitrocellulose.

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CELLULOSE PRODUCTS DEPARTMENT

HERCULES POWDER COMPANY
INCORPORATED

964 Market Street, Wilmington 99, Delaware

METAL plus work plus heat-treating make a spring. Specifications say so. But there's something else that makes the spring more than acceptable. It's the careful inspection of materials, the skilled design of tools and dies, the right kind of heat-treatment. You don't learn to make springs from a recipe. That may give you the ingredients—but only a desire to make the best springs can produce the kind that "stay sweet" longer. Gibson spring engineers have that desire, our skilled workmen "know how."

WILLIAM D. GIBSON CO.

DIVISION OF ASSOCIATED SPRING CORPORATION

1800 Clybourn Avenue
CHICAGO, ILLINOIS

We never knew engineers had so many troubles until we asked them recently to tell them to us.

So many responses have been received in answer to our Oil Seal advertisements that we are suspending our advertising until our engineering department completes their study of the problems already presented.

Almost every high-speed shaft oil sealing problem where pressures are involved, necessitates an individual diagnosis and treatment. This requires considerable time before a recommendation can be made and a seal fabricated for trial installation.

However, when your problem is solved, you can rest assured that a very important and vital part of your production schedule is permanently set and trouble free.

If you have sent us an oil sealing problem and have not yet received our recommendation, please be patient; it will receive individual attention in the order in which it was received.

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Manufacturers of
SIMPLEX
"FLYING PISTON"
RING

War planes using American Hammered Piston Rings

A-20 Havoc
A-24 Dauntless
A-25 Helldiver
SB2C Helldiver
A-29 Hudson
A-30 Baltimore
A-31 Vengeance
A-34 Buccaneer
A-36 Mustang
B-17 Flying Fortress
B-23 Dragon
B-24 Liberator
B-25 Mitchell
B-26 Marauder
B-34 Ventura
C-43 Traveler
C-45A Voyager
C-46 Commando
C-47 Skytrain
C-53 Skytrooper
C-54 Skymaster
C-56 Lodestar
C-61 Forwarder
C-69 Constellation
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J-4-F Widgeon
L-1 Vigilant
L-2 Hedgehopper
L-3 Grasshopper
L-4 Grasshopper
L-5 Sentinel
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* PROVING GROUNDS

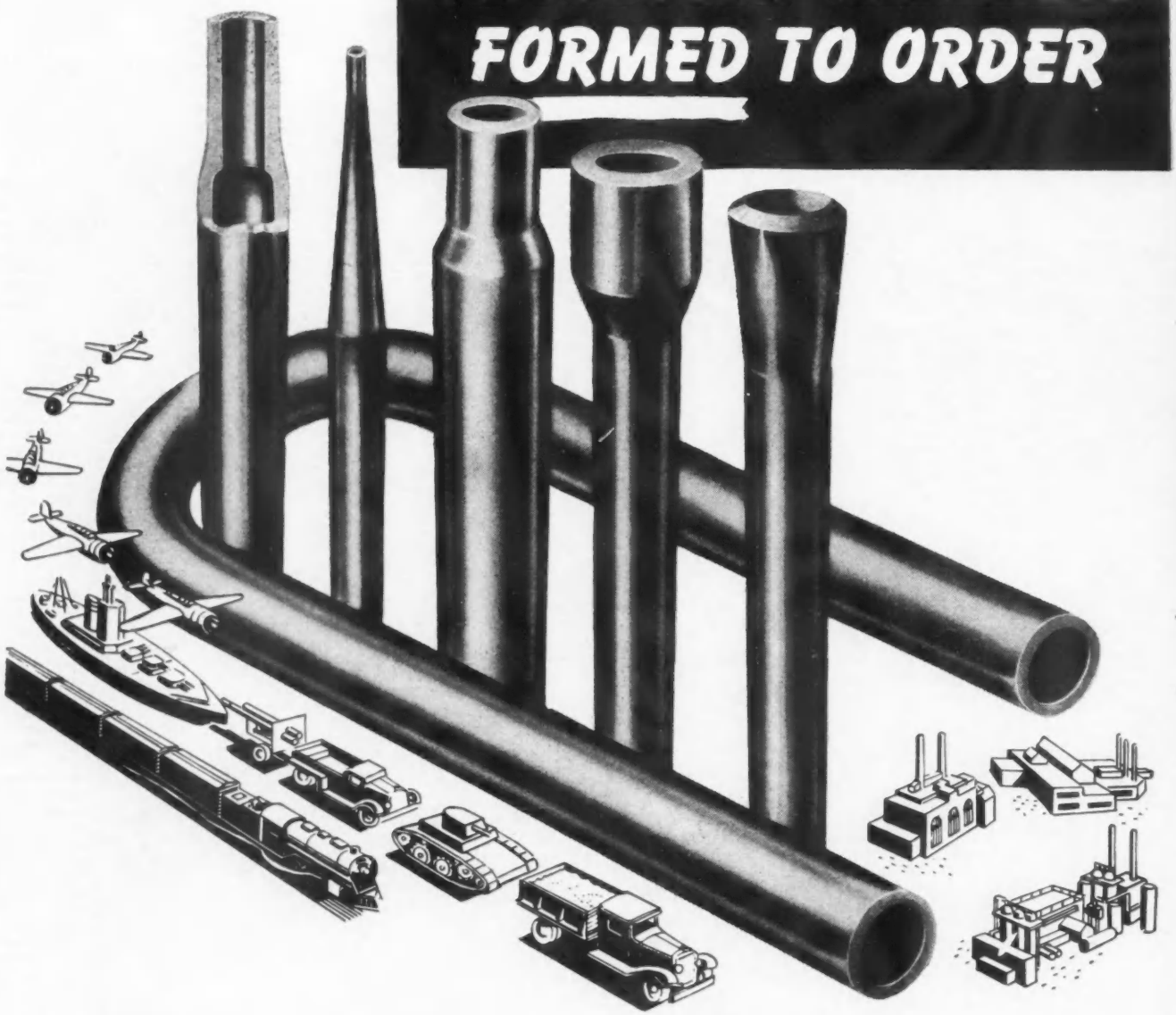
When German radios suddenly go dead, we know that American Hammered Piston Rings once more are demonstrating why they were chosen as equipment for 76 types of United States War Planes. These rings have multiplied by 5 the distances previously flown between engine overhauls. And in tanks, trucks, jeeps, barges, etc., they are setting almost unbelievable records. Koppers Company, American Hammered Piston Ring Division, Baltimore, Md.

B-17-E FLYING FORTRESS BOMBING BERLIN

American Hammered Piston Rings

A KOPPERS PRODUCT

PITTSBURGH SEAMLESS
FORMED TO ORDER



Pittsburgh Seamless Steel Tubing . . . in carbon, alloy or stainless grades . . . may be readily formed, within accepted limits of the steel, to meet today's manufacturing and production needs.

Pittsburgh Steel Company is equipped to fill many of these forming requirements to order.

If your uses of seamless tubing involve swaging, upsetting, expanding, tapering, flanging, bending or other forming, either hot or cold, you may often speed production by ordering tubing in these more finished shapes.

Send us your blue-prints and specifications for analysis and quotation.

PITTSBURGH STEEL COMPANY

1676 GRANT BUILDING PITTSBURGH, PA.

Pittsburgh Seamless STEEL TUBING

For better thin-metal welds and more of them . . .

The Wilson "Honey Bee"

With Wilson "Honey Bee" arc control stations you gain these three important advantages:

1. **BETTER QUALITY WELDS ON THIN METAL** through the "Honey Bee's" Remote Crater Control, a motor-driven device which enables the operator to fade out the arc slowly over a mechanically regulated time interval. It operates automatically when actuated, thus providing uniform arc fade-out and effectively preventing craters and porous welds.
2. **MORE ARCS PER GENERATOR** since two or more "Honey Bee" stations are operated from each constant potential generator, thereby multiplying the job-capacity of each generator.
3. **MORE PRODUCTIVE TIME** through Wilson Remote Arc Control which permits each operator to regulate current from zero to maximum while welding – without first extinguishing the arc.

All these features combine to make the "Honey Bee" a valuable aid to productive quality welding on thin metals. The "Honey Bee" is made in 75 amp. and 150 amp. sizes. For full details write to Wilson Welder and Metals Company or to any Air Reduction Sales Office.

IDEAL POWER SOURCE for "Honey Bee" stations is the popular Wilson "Hornet". Long favored for its outstanding all-around performance, the "Hornet" gives excellent service when operated as a constant potential generator. With a convenient quick-change switch, the "Hornet" may be quickly changed from standard to constant potential characteristics, and vice versa as required.

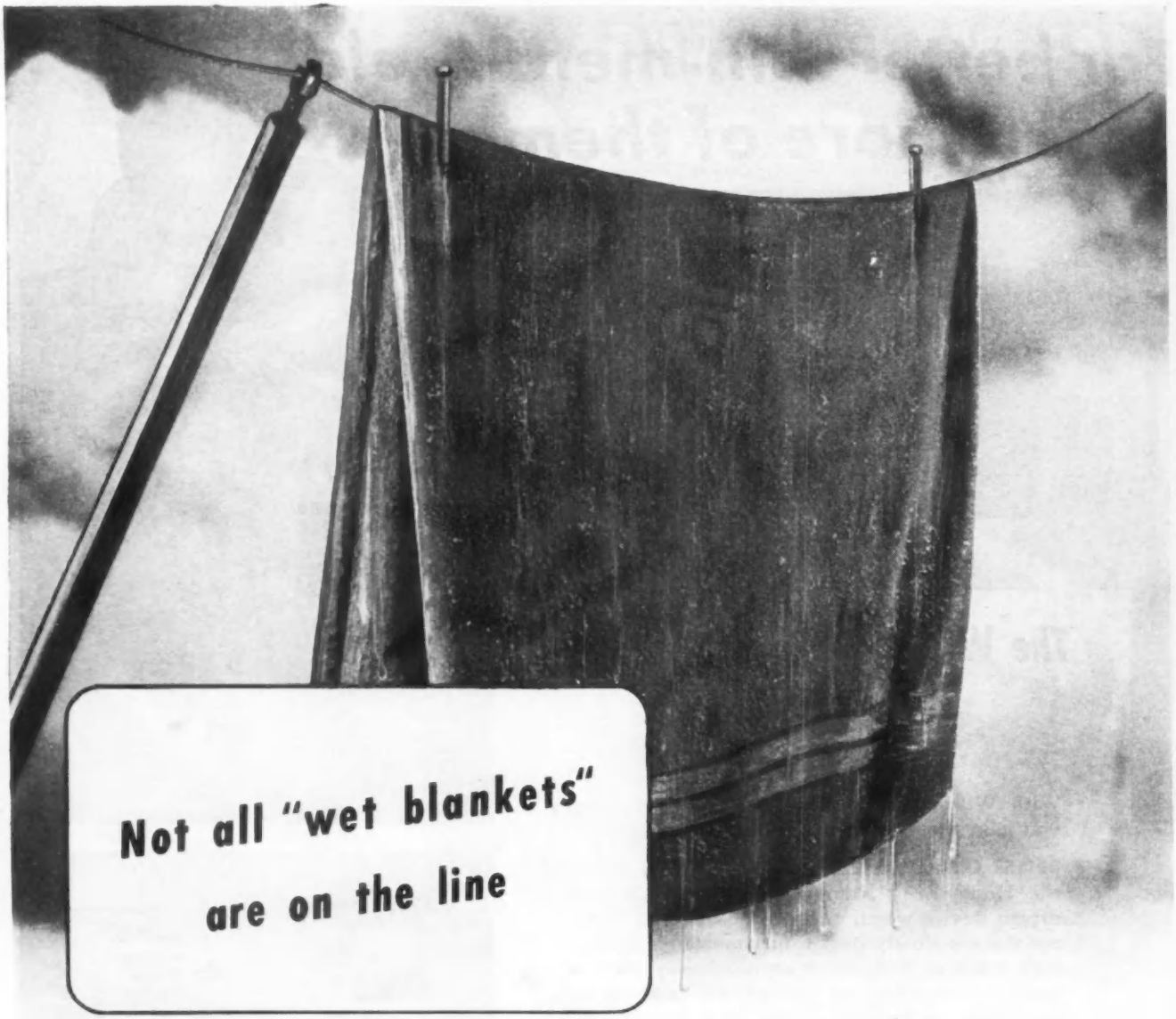
Photos courtesy of North American Aviation, Inc., of Kansas

WILSON

WILSON WELDER and METALS CO., INC.

General Offices: 60 East 42nd Street, New York 17, N. Y.

WILSON AC WELDERS — *distributed through Air Reduction Sales Company*



A WET blanket is heavy only because it has absorbed water. While none of the materials used in your planes resemble a blanket in appearance, many may absorb weight just as readily.

For instance, oil seals, hose, packing, gaskets, grommets, diaphragms and all other resilient parts when used in the presence of oil, may act like a blanket by absorbing weight not included in the original design calculations.

With thousands of such resilient parts in a single plane, the extra dead weight caused by oil-absorption may become a real "wet blanket" in its later performance.

That's why Hycar with its light weight—15% to 25% lighter than many other synthetics—and its superb resistance to oil to keep it light—gives protection against increased dead weight not offered by any other material.

Oil-swell can be closely controlled with Hycar to insure dimensional stability. And Hycar has an operating range of −65° to +250° F. and abrasion resistance 50% better than natural rubber. Unlike many other oil-resistant synthetic rubbers, Hycar has a minimum tendency to cold flow even at elevated temperatures, after taking the initial set.

You need these qualities in resilient materials used in the presence of oil. Let our technical service staff help solve your individual problems. *Hycar Chemical Co., Akron 8, O.*

Hycar

LARGEST PRIVATE PRODUCER OF BUTADIENE TYPE

Synthetic Rubber

THEN TRUCKS WILL BE

Braked Electrically

THE Allied Forces forge steadily onward—big artillery pieces, huge lorries and tractor-trailers keep pace with courageous fighters. Whether grinding up steep hills or creeping down dangerous grades, thousands of these machines of war are always kept under safe and complete control by Warner Electric Brakes. In tropical heat and arctic cold alike, Warner Electric Brakes are not affected by weather. After the war, America's great fleets of motor trucks and many other types of power equipment will be *braked electrically*—for war-proved Warner Electric Brakes will then be available for an ever-increasing range of applications.

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ELECTRIC BRAKES

Warner Electric Brake Mfg. Co.
Beloit, Wisconsin

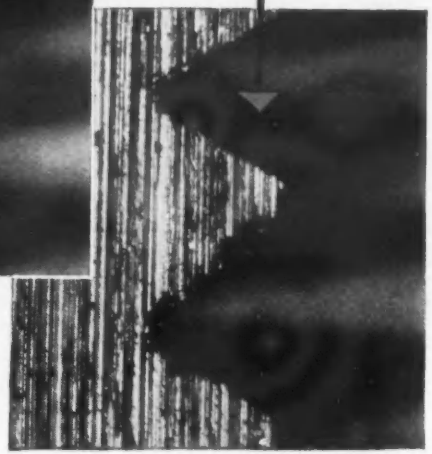
BUY WAR BONDS

CONTROLLED SPLIT-SECOND STOPPING POWER FOR ANY PURPOSE

Stronger.. BECAUSE IT FITS Tighter!

Photomicrographs showing:

- Typical snug-tight fit of Type 1 Shakeproof Thread-Cutting Screw.
- Typical loose fit of ordinary machine screw in pre-tapped hole.



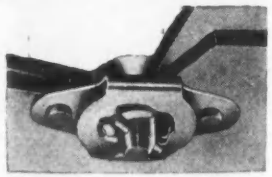
THE SCREW WITH THE "BUILT-IN" TAP!

SHAKEPROOF
THREAD-CUTTING SCREWS

Exclusive thread-cutting slot provides sharp serrated cutting edge. Each screw taps and fastens in one operation... reduces costs and improves product performance.

GOOD DESIGN DEMANDS MODERN FASTENINGS!

Shakeproof Lock Washers
In a variety of types and sizes.



Shakeproof Cowl Fasteners
"The Quick-opening Lock!"

Sems Fastener Units
Pre-assembled Shakeproof Lock Washer and Screw.

WRITE FOR FREE TEST KIT!

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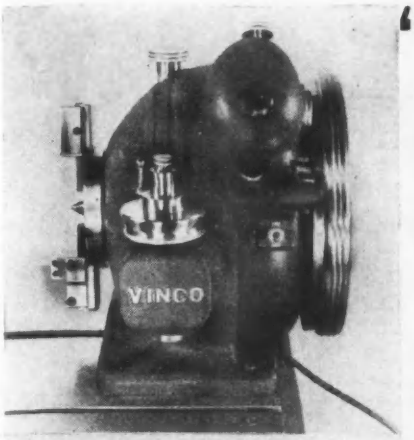
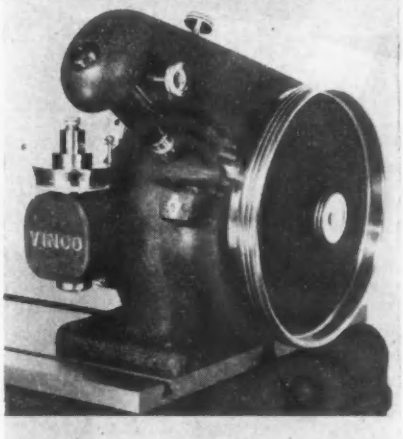
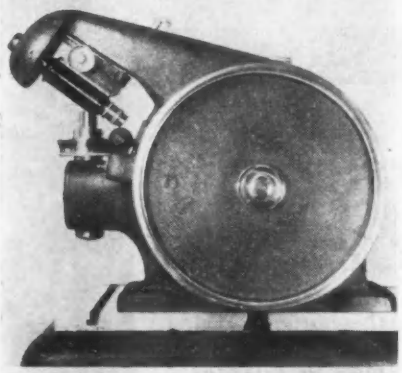
Plants at Chicago and Elgin, Illinois In Canada: Canada Illinois Tools, Ltd., Toronto, Ontario







"30 times more accurate"

For the past few years we at Vinco have been producing the Optical Master Inspection Dividing Head using the finest material and the best possible methods and workmanship in its production. We are informed, on high mathematical authority, that our Dividing Head is thirty times more accurate than others being used in inspection. The spindle in each instrument is carefully inspected and checked. The spindle run-out is guaranteed to within twenty-five millionths of an inch, total indicator reading; the average run-out however being approximately fifteen millionths. The Dividing Head is guaranteed accurate to within two seconds of arc, but experienced inspectors are able to match the lines viewed through the microscope to within 12½ millionths of an inch or ½ second of arc. It can therefore be seen that this Dividing Head operated properly is capable of great accuracy. Send for our folder.

VINCO CORPORATION
8869 SCHAEFER HIGHW'Y
DETROIT 27, MICH.

SALES OFFICES:
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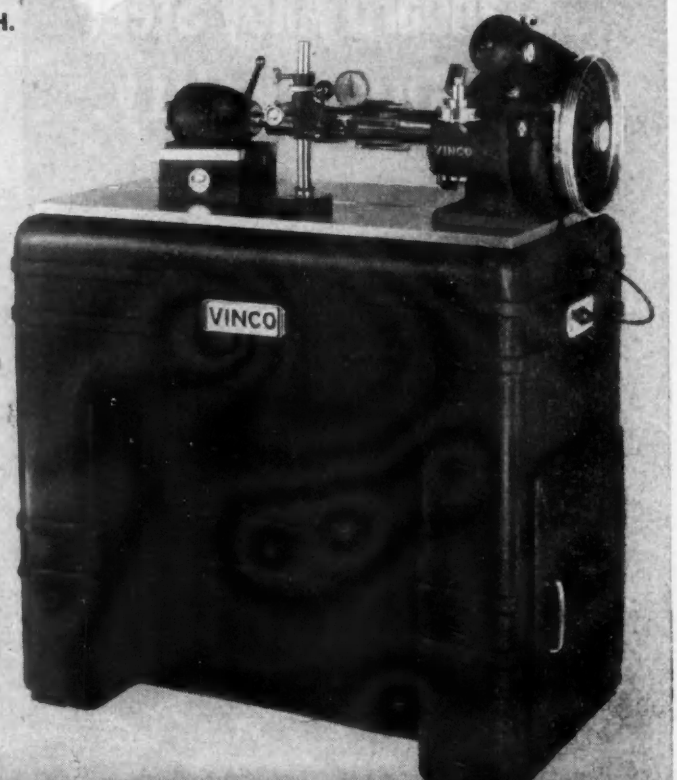

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Semi-Automatic Hydraulic Spline and Gear Grinder • Optical Master Inspection Dividing Head • Involute Checker • Angle Tangent to Radius Dresser • Index Plates • Precision Vises • Sine Bars • Straight-side Spline, Serration Spline, Involute Spline and Helical Spline Plug and Ring Gages • Thread Ring Gages and Masters • Spur and Helical Master Gears • Munition Gages • Propeller Hub Gages • Built-up and Special Gages • Gear Rolling Fixtures • Spline and Index Fixtures • Hydraulic Power, Control, Utilization and Distribution Units • Engineering, Design and Development

DISSTON offers

Standard Alloy Steel for Airplane Parts...

★

Standard Alloy Steel of Gun Quality...

These fine Disston Steels are produced by modern tool steel practice in electric furnaces, under precise control and expert supervision.

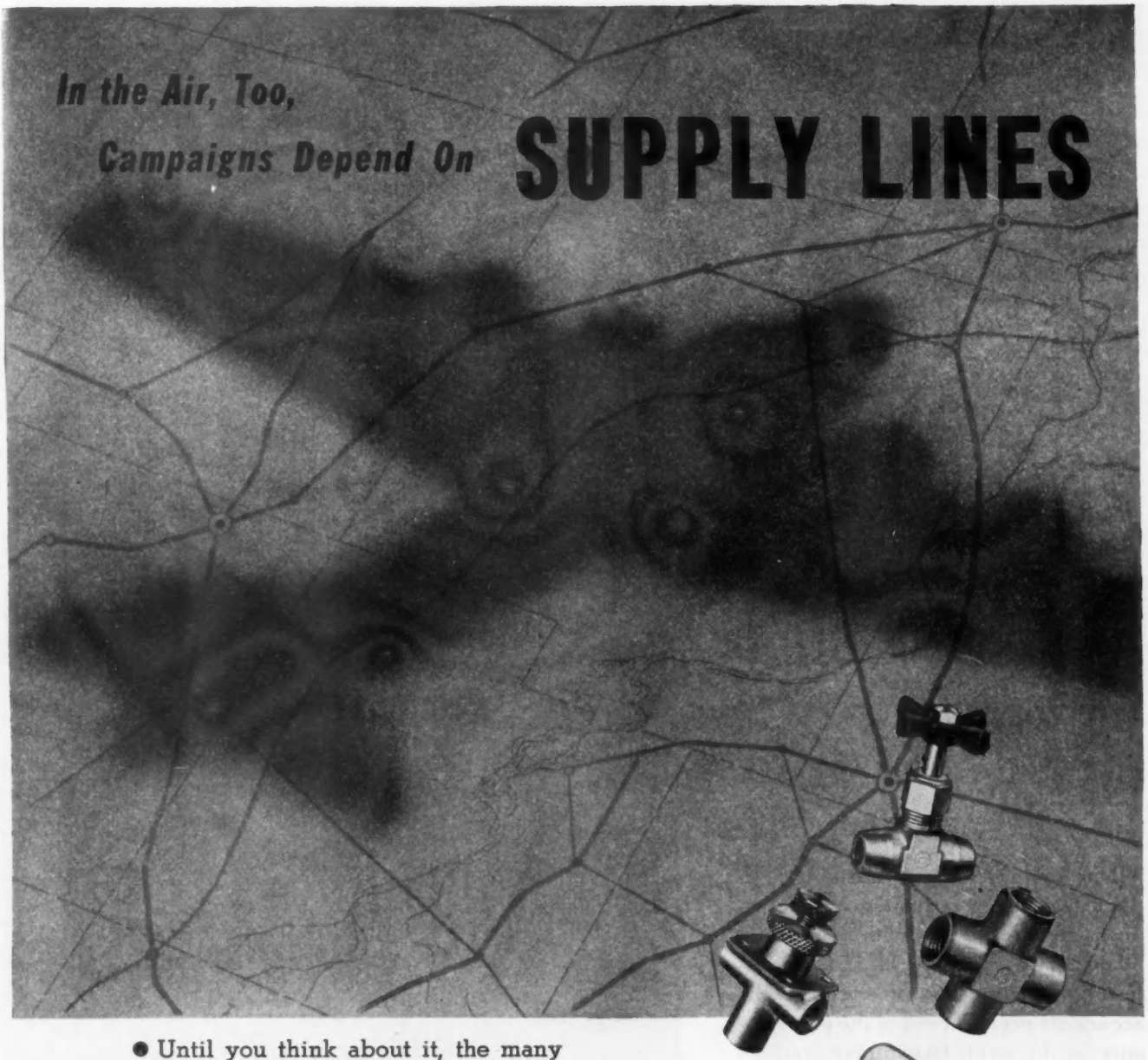
Cooperation on Postwar Planning

The exceptional experience and broad background of Disston metallurgists and engineers in the manufacture and application of special tool and carbon steels are available — without obligation — to help you on any anticipated postwar problems. Write fully.

HENRY DISSTON & SONS, INC., 231 Tacony, Philadelphia 35, Pa., U. S. A.

In the Air, Too,

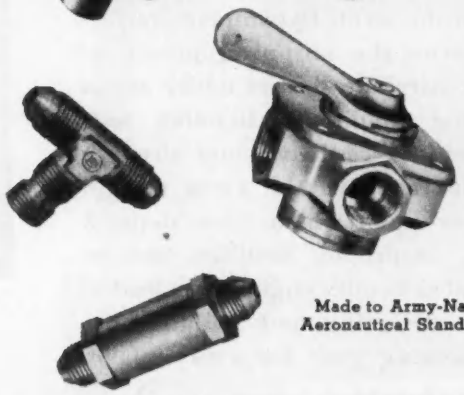
Campaigns Depend On **SUPPLY LINES**



● Until you think about it, the many valves and fittings in a plane may seem no more important than nuts, bolts and rivets.

But Dole Aircraft Valves and Fittings have proved that precise uniformity within specified tolerances is a quality which prevents failures in the many supply lines—gas, oil, air, oxygen, etc.—where failure would endanger large plans.

When you need valves and fittings remember the high standards of Dole design and manufacture.



Made to Army-Navy Aeronautical Standards

DOLE

THE DOLE VALVE COMPANY

Incorporated 1906

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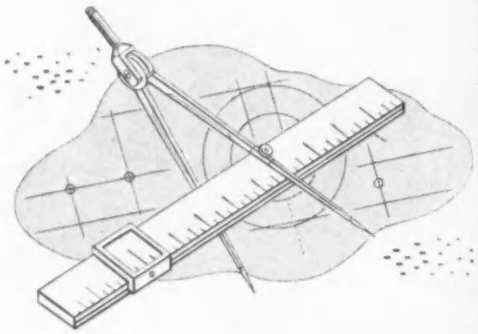
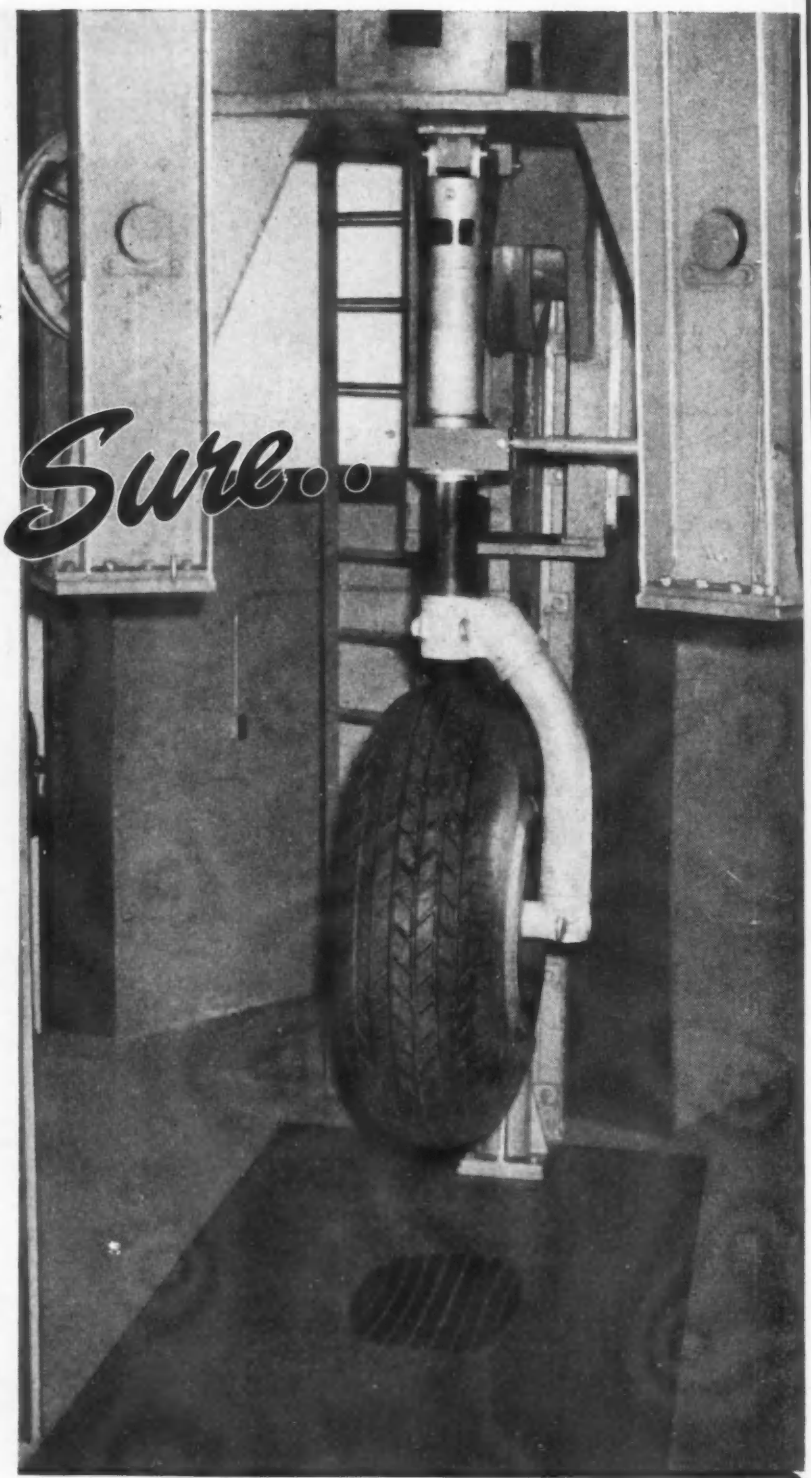
Also Manufacturers of: **Tube Fittings, Valves and Cocks (Automotive)—Leakproof Primers—(Radiator) Air and Vacuum Valves—Dispensers for Carbonated Beverages Motor Temperature Control Thermostats—Tempering Valves for Washing Machines**

AIRCRAFT VALVES and FITTINGS





Just to be Sure...

that Bendix* Struts perform as planned

When Bendix designs a strut for a plane, engineers' estimates of performance are checked by the most modern laboratory equipment. The giant drop-testing machine shown at the right accurately pre-determines the performance of the strut. Dynamometers predetermine the stopping power of Bendix Airplane Brakes under actual operating conditions. Bending tests measure the resilience and strength of struts, assuring the extra margin of safety upon which lives depend. Bendix inspection facilities are as essential as Bendix engineering leadership in designing and building the right landing gear for every plane.

*Trademark of Bendix Aviation Corporation

THE INVISIBLE CREW

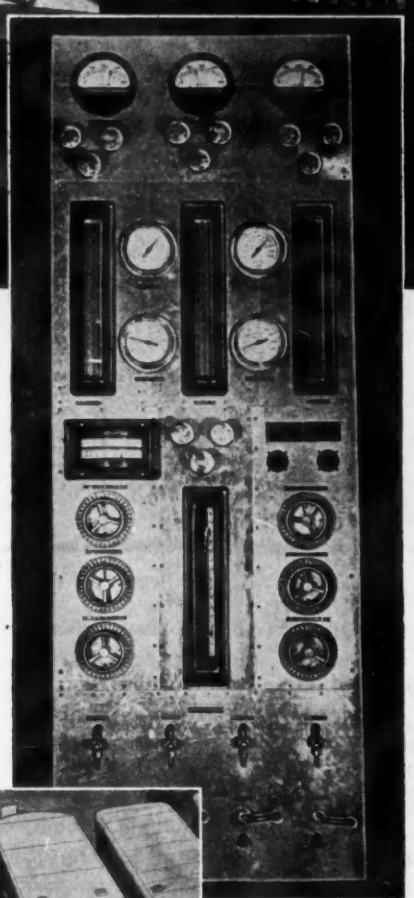
Precision Equipment by **Bendix Aviation Corporation**

BENDIX PRODUCTS DIVISION
SOUTH BEND, INDIANA

Bendix*Landing Gear—Bendix Pneudraulic Shock Struts, Bendix*Airplane Wheels, Airplane Brakes, Hydraulic Master Cylinders, and Power Brake Valves are important members of "The Invisible Crew" of precision equipment which more than 30 Bendix plants are speeding to world battle fronts.

SCHOOL DAYS for Mechanized WARFARE

Corner of classroom at the Independent Engineering Co. plant, O'Fallon, Illinois.



ANOTHER **FIRST** for Independent . . . a course of specialized training for men of the armed forces in the handling of industrial gas producing equipment. In this way, the superior design and manufacturing principles of Independent Engineering is matched with highest technical skill . . . an *unbeatable* combination in the field of mechanized warfare.

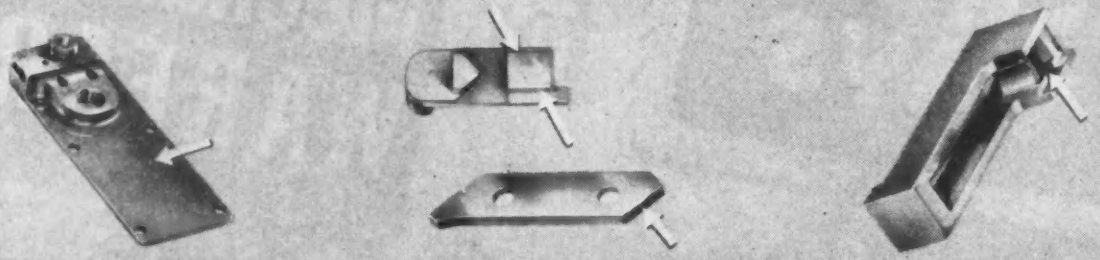
When Victory is won—these trained operators, using Independent Equipment, will be able to serve you *best* in your peacetime pursuits.

Independent Engineering Co.– Pioneer designers and producers of mobile Oxygen and Hydrogen generating plants for the armed forces . . . builders of Oxygen, Hydrogen and Acetylene plants– manufacturers of industrial gas cylinders and cylinder handling equipment.

Independent Engineering Co.

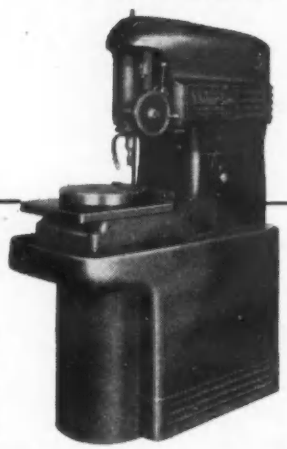
103 WEST SECOND STREET—O'FALLON, ILLINOIS

ON PLAIN MILLING OPERATIONS LIKE THESE



SAVE TIME AND MONEY AND MANPOWER

BY USING THE THOMPSON AUTOMATIC PROFILE MILLER



A number of large manufacturers of precision parts are now making substantial savings on a wide variety of plain milling operations by using Thompson Automatic Profile Millers. These are operations that can utilize the advantages of multiple stations, continuous work table movement, elimination of loading time . . . and other features of this versatile and unusual production machine.

Continuous movement of the work table presents a station to the operator for unloading and reloading at regular intervals and thus "paces" the work . . . production rate is determined by the speed of the machine cycle rather than by the inclination of the operator. The complete elimination of loading time and the use of automatic rapid traverse between stations assure that the cutter is working the maximum amount of time. Because the path of the cutter can be irregular and varied instead of only a straight line, the Thompson Automatic Profile Miller eliminates operations on some plain milling jobs that would otherwise require additional equipment, loading and handling.

Write for a copy of new Bulletin 44-A; it describes the many advantages of the Thompson Automatic Profile Miller.

EARL A. THOMPSON MANUFACTURING COMPANY
1300 HILTON ROAD • FERNDALE, MICHIGAN

THESE are the quality features you get with every Standard Carboloy Tool:

Cold drawn steel shanks—with the strength to "take it" on even the "toughest" jobs. Full-size Carboloy Tips—amply large to permit grinding to wide range of special shapes. Extra-strong braze—copper braze—of tip to shank. Cutting rakes and angles accurately incorporated for wide range of work. Each tool diamond-ground, ready to *start* cutting and *keep* cutting for long periods of operation. Entire tool shank area colored for instant, unmistakable identification.

These and other quality features of Carboloy Standards are available to you at prices comparable to all types of cutting tool materials—prices made possible by unprecedented demand and mass production economies.

Stocked in 10 styles, wide range of sizes and five standard grades.

CARBOLOY COMPANY, INC.
11151 E. 8 MILE AVE., DETROIT 32, MICHIGAN

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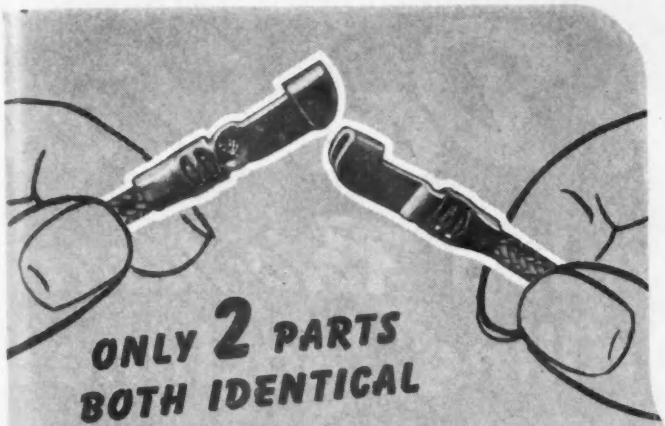
For Cutting CAST IRON and Non-Ferrous Metals
For Cutting STEEL

TUNGSTEN CARBIDES ★★★ TUNGSTEN CARBIDES WITH TANTALUM AND/OR TITANIUM CARBIDES

In the Vengeance . . .

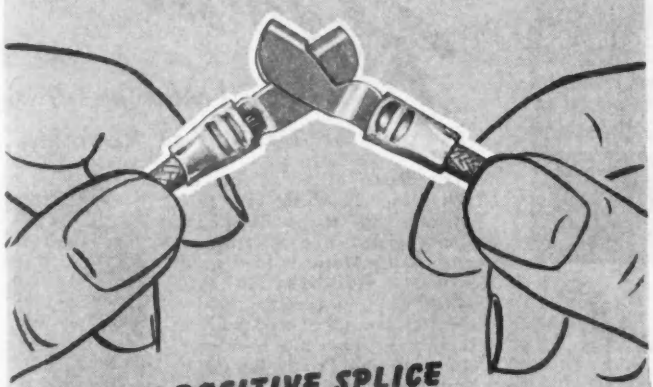
Vital parts of the Wright engine which powers the Vultee Vengeance are made of Bethlehem Aircraft Quality Steels.

☆ BETHLEHEM STEEL ☆ **BETHLEHEM AIRCRAFT QUALITY STEELS**



ONLY 2 PARTS BOTH IDENTICAL

Eliminates stocking more than one item. Incorporates AMP Diamond Grip Insulation Support features.



QUICK POSITIVE SPLICE

Knife-Switch principle affords 4 surfaces of direct contact to assure maximum conductivity through the coupling.

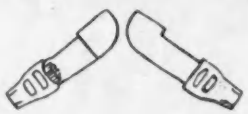
STAYS TOGETHER UNTIL INTENTIONALLY TAKEN APART

Tensile strength of splice is greater than that of the wire itself, yet assembly is easily and quickly uncoupled when desired.

CONTOUR OF ASSEMBLY FIRMLY HOLDS INSULATION TUBING

With the tubing in place the splice cannot be accidentally disconnected.

AMP Solderless



SPLICING TERMINAL

With Diamond Grip INSULATION SUPPORT

1. Unique locking principle using only 2 identical parts — no third part to stock or lose.

2. Four-point "Knife-Switch" wiping action assures minimum contact drop through the coupling, and gives a perfect electrical connection even under adverse conditions.

3. AMP Diamond Grip insulation support gives maximum protection for insulation at wire end of connection.

"PRECISION ENGINEERING APPLIED TO THE END OF A WIRE"

4. Cannot be uncoupled by pull on the wire — tensile strain on the wire tends to further engage the coupling.

5. Visual inspection after assembly. Wire goes through the barrel of the splicing terminal, insuring against possibility of wire being only partly inserted in the barrel.

6. Makes a connection which will withstand any but the most excessive abuses in service. Flexible copper and simple construction permit easy return to original shape if distorted in service.

7. Insulation sleeving slips over entire assembly with ease. A fairly loose insulation sleeve expands to clasp oval formation of entire assembly — to remain firmly in place until removal.

8. Offset tongue acts as wire stop, preventing the insertion of the wire to a point where it would interfere with the coupling.

9. AMP crimping tools make all three crimps in one operation.

AIRCRAFT-MARINE PRODUCTS INC.

1521-55 N. FOURTH ST.
HARRISBURG, PENNA.
TELEPHONE: HARRISBURG 4-0101

AIRCRAFT-MARINE PRODUCTS INC. AMP SOLDERLESS WIRING DEVICES

Production Doubled with a Roto-Matic Drilling Machine!

● Tooling set-up for drilling the wrench. Part is manually loaded.

200 More Wrenches Per Hour with this *Continuous* Drilling Method

Over six 6-inch wrenches per minute — 400 per hour — were obtained by this manufacturer with the Roto-Matic Drilling Machine, with only one operator. Previous production, using a six-spindle conventional gang drill, was 200 wrenches per hour. The operation consists of drilling a 3/8" dia. hole by 2" deep.

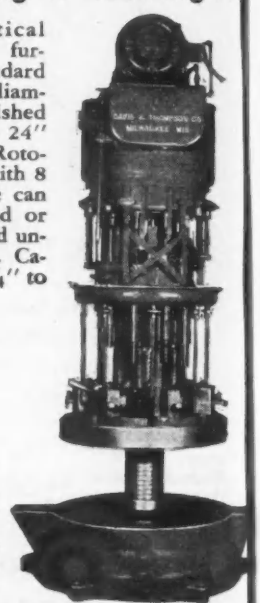
This is just one of many Roto-Matic installations which is setting outstanding production records throughout the metal working industry. Perhaps you can obtain similar or better performance through the application of this principle to your drilling. Our engineers will be glad to work with you in adapting this high production drilling machine to your work. Call on them without obligation.

What the Roto-Matic Principle is . . .

The Roto-Matic Drilling Machine is not an indexing type machine. The drills and work rotate continuously while the operator loads and unloads as the work passes the loading station. Feed to the spindles is obtained through an adjustable cam. The machine can be furnished in both vertical and horizontal models and in addition to drilling, the Roto-Matic principle can be applied to milling, reaming, spinning, counter-boring, spot-facing, balancing correction drilling and similar operations. Investigate the application of this machine or a similar machine to your work today.

The Roto-Matic . . . A Basically Standard Machine for High Production Drilling or Reaming . .

The Roto-Matic Vertical Drilling Machine is furnished in three standard basic sizes. The 36" diameter Roto-Matic is furnished with 12 spindles. The 24" and 18" diameter Roto-Matics are furnished with 8 spindles. The machine can be provided with hand or automatic clamping and unclamping of the work. Capacities in steel from 1/4" to 2" diameter.



Basic Davis & Thompson Roto-Matic Drilling Machine. Only fixture and tooling are the necessary special engineering required to adapt this machine to an endless variety of work.

Readily Changed from One Job to Another . . .

The spindle feed lengths are governed by cams which can be changed over from one job to another with a minimum of down-time. This makes it possible to run several jobs of moderate-lot sizes over the Roto-Matic and increase production over conventional drilling machines.

A "Pace-Setter" on the Production Line

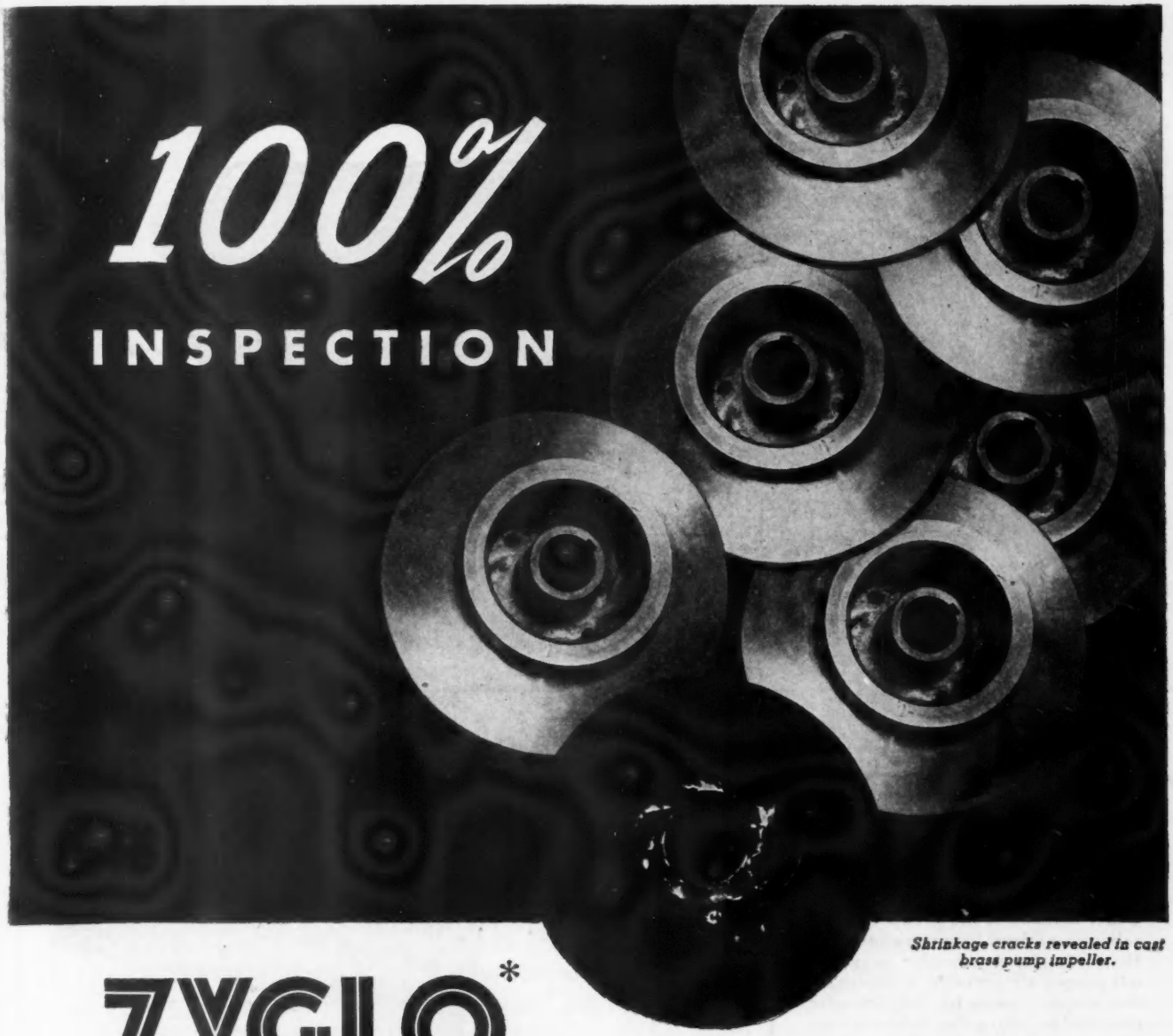
Since the work is in constant rotation and set at a definite feed rate, the production is pre-determined and the operator need only to unload and load the work as each spindle passes the loading station. This eliminates unnecessary delays in the loading station which are often common with conventional indexing type drilling machines.

Free— This booklet contains other examples of Roto-Matic Solutions, and other high production machines. Ask for Bulletin No. AI-244.

DAVIS and Roto-Matic THOMPSON

Davis & Thompson Company

MILWAUKEE • WISCONSIN



Shrinkage cracks revealed in cast brass pump impeller.

ZYGLO*

BLACK LIGHT METHOD Permits Pre-Inspection for Flaws of Every Part in Production

Methods of parts inspection by "sampling" or inspecting random specimens cannot be expected to assure 100% flaw-free finished assembled products. Conversely it *can* be expected that 100% inspection—examining every part produced—will assure results closest to that ideal.

Zyglo allows 100% inspection in fields where it was not before possible or economical. Any solid material whether metal, glass, ceramic or plastic can be inspected.

Zyglo's brilliant fluorescent indications enable the rejection of parts susceptible to failure and also focus attention on the correction of production operations which cause the flaws.

Let us make an actual demonstration inspection of your product.

• • •

**ZYGLO—The Trade Mark of Magnaflux Corporation applied to its equipment, material and methods for fluorescent penetrant inspection.*

MAGNAFLUX CORPORATION

5904 Northwest Highway, Chicago

NEW YORK • DETROIT • CLEVELAND • DALLAS • LOS ANGELES

A Brief Message from an Amphibian to..

INDISPENSABLE ALLIES IN TIRE CONSERVATION

Schrader Valves, Cores, Caps and Gauges save rubber.

Under-inflation is the greatest single saboteur of tires! You can control it. How? 1. Use a Schrader gauge to tell proper air pressure. 2. Maintain that proper pressure by using *Schrader cores* and by seeing that *Schrader caps* are on every valve. For, it's the *CAP* that guarantees an air-tight valve. 3. Check again with the air gauge from time to time to see that proper pressure is maintained. 4. Then if extra leakage occurs, look for a tube leak.

It swims or it rides—its tire valves doubly protected by Schrader Cores and Caps. Our armed forces depend on these mighty mites, for unfailing performance for all tires from bicycles to the biggest bomber built. You can depend on them too.

DEPENDABLE

In the aviation and automotive industries Schrader tire valves, cores, caps and gauges are playing a vital role. Other Schrader valves used in life rafts, life vests, barrage balloons, oxygen equipment and in other important products also play their part in helping win the war! You can rely on Schrader products. You can specify them with complete confidence.

AND NOW SCHRADER AIR CONTROLS

To speed production in factories

To speed production, to increase safety and to decrease costs—compressed air is being used more than ever before for machine control, safety control and ejection methods! Write today for our catalog No. 10 showing many applications that may help your production problems.

SCHRADER PRODUCTS HELP SAVE RUBBER

Replaceable Tire Valves • Valve Cores • Air Sealing Valve Caps • Air Chucks • Valve Repair Tools • Pencil Type Gauges • Service Gauges • Airline Couplers • Vulcanizers

A: SCHRADER'S SON, *Division of Scovill Manufacturing Company, Incorporated,* BROOKLYN, NEW YORK

ENGINEERED TO FIT THE JOB!

Jessop Specialty Steels

Jessop Electric Furnace Alloy Steels are engineered to fit the job. They are the result of modern steel-making practice combined with years of experience in producing high alloy steels having the desired characteristics to meet the requirements of exceptional applications. Warehouse stocks of standard analysis products are maintained in principal production centers for quicker service. Available, too, is the assistance of our field servicemen, who will gladly advise you regarding the availability and application of Jessop Steels. Consult us also on your problems requiring special analysis alloy steels in which quality and accuracy are primary considerations.

- ★ X-4130 Sheets
- ★ Stainless Steel Bars, Sheets and Plates
- ★ Valve Steel Bars
- ★ Cold Rolled Untempered Strip and Sheet in High Carbon, Special Alloy, and Tool Steels
- ★ Cold Rolled Tempered in Strip
- ★ Composite Stainless and Composite Tool Steels
- ★ Tool and Die Steels
- ★ Cemented Carbide Tools
- ★ High Speed Tool Bits

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HEAD OFFICE AND WORKS
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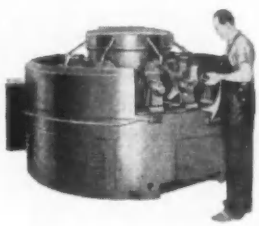
ARMY E NAVY
JESSOP STEEL CO. FINE JESSOP STEELS WASHINGTON PA.
Established 1901

WAREHOUSES:
CHICAGO • CINCINNATI
CLEVELAND • DETROIT
HARTFORD • TORONTO
★

call for NEW post-war production plans NOW!



SNYDER KNOWS HOW

This 8-spindle rotary turning machine was developed by Snyder to perform a single operation in multiples of eight or successive operations in multiples of four, on hubs, flanges, pistons, etc., made of steel, cast iron, aluminum and other alloys.

Each of the eight spindles is an individual turning and facing machine performing a complete operation upon an individual workpiece while the workpiece rotates and while the central turntable carries the operating assembly around the circle, from, and back to the unloading and reloading position.

Spindle and turntable speed both are changeable through pick-off gears, adapting this machine to a wide variety of applications.

SNYDER CAN GIVE YOU REAL HELP IN PLANNING MACHINES FOR ECONOMICAL PRODUCTION

● If you are planning new post-war products, you also are concerned with questions of how those products will be produced—how *quickly* they can be produced and made available to waiting markets—how *economically* they can be produced so that the largest possible market can be reached. To answer these production questions you must know what machines will best serve your production needs and you must know where and when these machines can be designed, built and delivered to you. For sound planning, you need this information *now*.

Snyder is ready to help you to project your production plans into the post-war period, ready to co-operate with you in designing machines that will automatically perform one or many operations, automatically maintain specified tolerances, automatically deliver the hourly production you will require to establish and hold your market position and to sustain a healthy payroll.

With such plans completed NOW, your machines will be ready to start through the Snyder plant as soon as restrictions are lifted on building machines for non-war production. Delivery to you can then be accomplished in the shortest possible time.

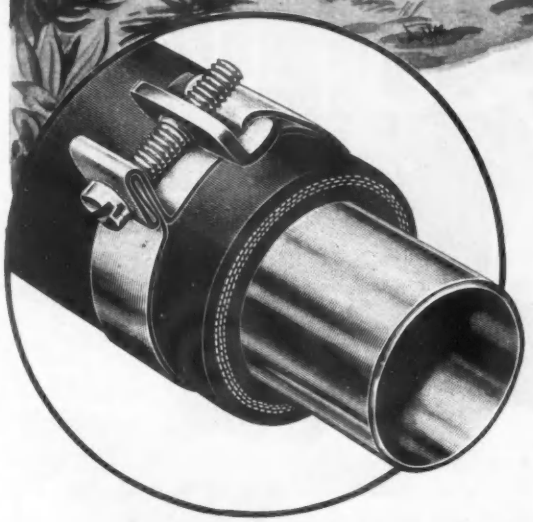
We invite you to write us in full confidence. *Snyder Tool & Engineering Company, 3400 E. Lafayette Ave., Detroit 7, Michigan.*

PLAN Your PRODUCTION
when you
PLAN Your PRODUCT

SNYDER
DESIGNERS AND BUILDERS OF SPECIAL-PURPOSE MACHINES FOR HIGH PRODUCTION AT LOW UNIT COST

20 Years of Successful Co-operation with Leading American Industries

CENTRAL UNIVERSAL HOSE CLAMPS IN *Action*



● ***Central Universal Hose Clamps*** **are used in the production and servicing of Army and Navy trucks, jeeps, half-tracks, amphibians, cranes, bull-dozers, etc.; also as original and replacement equipment on road-rollers, farm machinery, portable saws, searchlights, marine, diesel and gasoline engines, and for all types of radiator hose.**

CENTRAL CLAMP-POWER KEEPS THE *Ducks* MOVING

The mighty "Duck" is the Army's amazing amphibious truck that carries men, guns, materials and ammunition from invasion boats to shore. It has to stay watertight and it has to keep moving! And Central Universal Hose Clamps, with unfailing dependability, supply the clamp-power that keeps it watertight and moving!

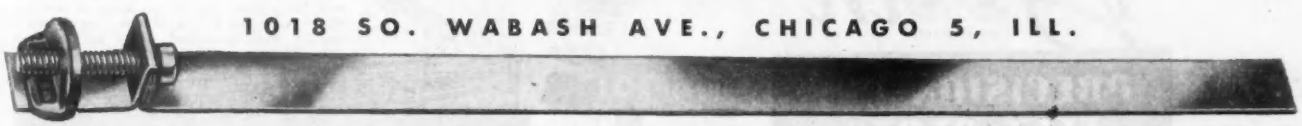
Made of rustproof, extra heavy rolled steel, these Central Clamps are powerful enough to withstand abnormal pressure, stress and vibration. They are leakproof, self-locking, 100% universal, and cannot strip or loosen.

They are easier to use in hard-to-get-at places, and can be attached or removed without disconnecting line. They come packed flat, and are standard for all production and service needs.

SEND FOR FREE SAMPLE

CENTRAL EQUIPMENT CO.

1018 SO. WABASH AVE., CHICAGO 5, ILL.



A SINGLE-LENGTH CENTRAL UNIVERSAL HOSE CLAMP MAKES HUNDREDS OF DIFFERENT SIZES

Copyright 1944 by C. E. Co.

Absorbed 578% of its weight in oil!

After 24 hours' immersion in S.A.E. 20 oil, wick specimens (each .25″ diam. x 30″ long) of six different types of Booth "prescription" felts were surface-drained and then weighed. Oil absorption as high as 578% of the original weight of specimen was recorded.

Various Booth felt tests, by independent laboratories, may give you new angles on felt. Ask for copies of the reports.

THE BOOTH FELT COMPANY
481 19th Street Brooklyn, N. Y.
737 Sherman Street Chicago, Ill.

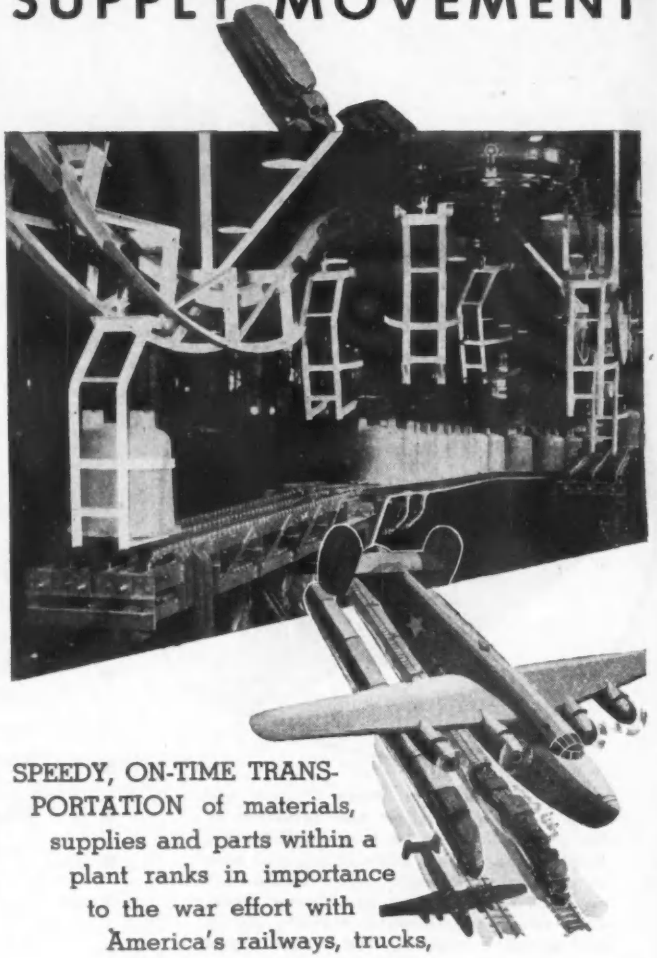
APPLICATION CHART AND SAMPLE KIT . . . Contains swatches of S.A.E. felt types, with specification tables. Write for it. (No sales follow-up.)

2074

Booth
TRADE MARK

PRECISION CUT FELT PARTS

Common Carriers VITAL TO WAR SUPPLY MOVEMENT



SPEEDY, ON-TIME TRANSPORTATION of materials, supplies and parts within a plant ranks in importance to the war effort with America's railways, trucks, ships and cargo planes. A well-engineered Conveyer System, geared to the speed of workers and machines, is a practical method of improving production from the receiving of raw materials right through to the shipping area.

MATHEWS CONVEYERS FOR MECHANIZED PRODUCTION

If you are manufacturing war material, or anything vital to the success of the war effort, you can get Mathews Conveyers to handle that material. Rely as usual on your Mathews Engineer.

MATHEWS CONVEYER COMPANY ELLWOOD CITY PENNSYLVANIA

HERE'S WHERE FOOD Really FIGHTS FOR FREEDOM!

Federal-Mogul Bearings Equip Carrier Refrigeration on the "D-E" U-Boat Killers

Good food and plenty of it, helps Destroyer-Escort crews keep fit to fight bitter ocean weather as well as U-boats—and to outfight both! Carrier refrigeration units, equipped with Federal-Mogul sleeve bearings, are compact and dependable in the toughest service. They protect fresh foods and provide variety in meals on the longest voyages.

From our six well-equipped plants, 24 hours a day, go tens of thousands of sleeve bearings, bushings and precision parts in many types and sizes, to equip aircraft engines and landing gear, for guns, tanks, torpedoes, submarines —and propellers for the same D-E vessels, PT boats and many other military craft.

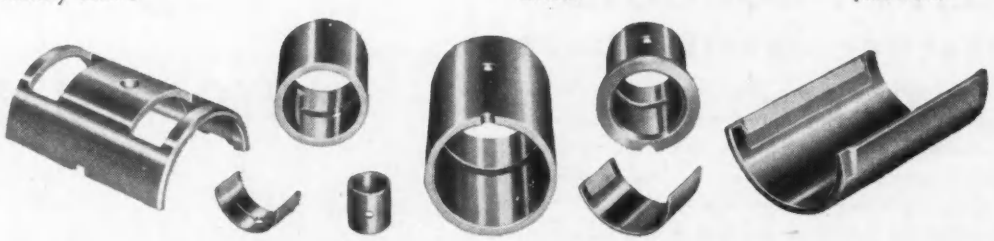
After the war—whether you build automobiles, trucks, tractors, refrigerators, diesel engines, steam turbines, heavy-duty electric motors — remember that wherever shafts turn in sleeve bearings, for 45 years FEDERAL-MOGUL sleeve bearings have been the recognized standard of dependable quality.

FEDERAL-MOGUL CORPORATION, DETROIT 13, MICHIGAN

Bearing Specialists Since 1899...

Sleeve bearings and bushings designed, developed and manufactured for engines, pumps, compressors, large machine tools and all applications where such parts are used.

Manufacturers of Equi-Poise and Tru-Pitch marine propellers from 8 inches to 10 feet diameter; Equi-Flex cushion stuffing boxes and shaft logs; struts, propeller shafts.



FEDERAL-MOGUL

SLEEVE FEDERAL Mogul **BEARINGS**

MAINTAINING a TRADITION for ACCURACY

"CHICAGO SCREW" QUALITY PRODUCTS meet exacting specifications

Accuracy has been traditional with The Chicago Screw Company ever since the company was founded over 70 years ago. On runs of *hundreds* or *millions*—we maintain exacting specifications for tolerances and finishes . . . This excellence in production of all our Screw Machine and Cold Upset Products cover all operations involving Hardening and Grinding, Slotting, Milling, Threading, Broaching, Thread Milling and Thread Grinding.

THE CHICAGO SCREW CO.
ESTABLISHED 1872
1026 SO. HOMAN AVENUE CHICAGO, ILL.

A RUNNING START *for* *Post-War Hurdles*

After this war is won, there are still going to be plenty of hurdles for business men to clear.

And clearing them in stride will best be accomplished from a running start, such as consistent advertising in AUTOMOTIVE *and Aviation* INDUSTRIES will help to provide.

The time to make such preparations, of course, is now.

AUTOMOTIVE *and Aviation* **INDUSTRIES**

A CHILTON Publication

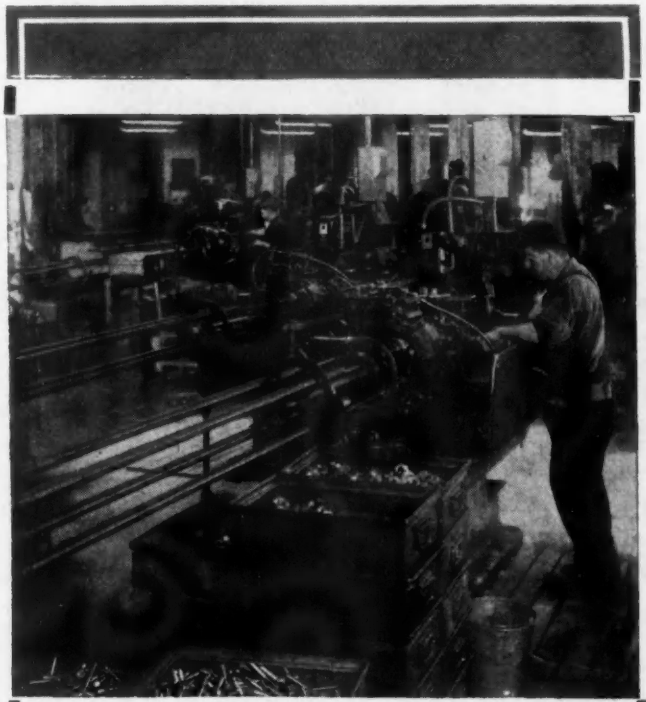
Chestnut and 56th Streets, Philadelphia 39, Pa.

• Two excellent application examples of thin, light and strong THINSTEEL are the precision parts for radio tubes and precision made razor blades. Though the physical characteristics required in these cases widely differ, it again discloses the real versatility of C M P THINSTEEL. In the present Production - for - Victory program, THINSTEEL in gauges thin as .001 has helped in numerous critical material situations by successfully replacing light gauge non-ferrous metals. This proves its adaptability for jobs previously thought neither feasible nor practical for steel.

• With the certain approaching peacetime product plans you'll be interested in the production economy and other THINSTEEL advantages. Wouldn't it be wise to investigate C M P THINSTEEL for your products right now?

THE COLD METAL PRODUCTS CO.
Subsidiary of The Cold Metal Process Co., Youngstown, O.

GIVES MAXIMUM PRODUCTION PER TON



FOR SCREW MACHINE PRODUCTS

Write Ritco

All types of screw machine products to blueprint, in all materials. Sizes: round stock 3/16" to 2⅝"; hex. stock 3/16" to 2¼". RITCO's modern screw machine equipment assures high accuracy and fine finish.

SPECIAL BOLTS, NUTS AND STUDS
DROP FORGING & DIE SINKING
SCREW MACHINE PRODUCTS
HEAT TREATING
SPRAYED METAL SERVICE
PARKERIZING

We will gladly quote on your specifications.
Catalog on Request

RITCO

RHODE ISLAND TOOL COMPANY

148 West River St., Providence 1, Rhode Island

Serving American Industry Since 1834

PRECISION IS A "MUST" IN EVERY CANNON OPERATION

Every part of every Cannon Connector is rigidly held to close tolerances through a well established quality control system.

Such precision not only assures absolutely dependable operations, but it is the main reason why original assemblies are made with ease, and why all parts are so easily interchangeable.

Take the AN line for instance: Split shells (pioneered by Cannon) of flawless alloys, fittings that are die-cast instead of stamped, contacts milled for close tolerance and low voltage drop.

Cannon Plugs are never made to meet a price. Their quality is controlled from raw materials to finished unit. The low cost of Cannon Plugs is due to efficient and large scale production.

For easier assembly—for more dependable service—use Cannon Plugs for all electric circuit connections.

CANNON BATTERY CONNECTOR—GB-3-34B Receptacle and GB-3-21B Plug shown at left are adapted to general industrial uses as well as quick disconnect of engine starting units in aircraft. This Cannon line covers a wide variety of types which are listed in the New Battery Connector Bulletin—free upon request. Address Department A-109, Cannon Electric Development Co., 3209 Humboldt St., Los Angeles 31, California.

CANNON ELECTRIC

Cannon Electric Development Co., Los Angeles 31, California

Canadian Factory and Engineering Office:
Cannon Electric Company, Limited, Toronto, Canada

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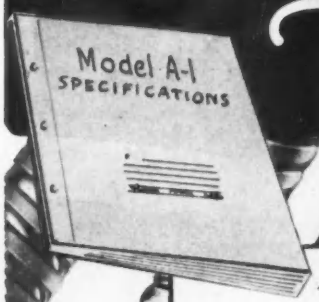
WHEN "SPECS" CALL FOR THE BEST IT'S WALKER-TURNER Flexible SHAFTING



★ Walker-Turner Flexible Shafting is not a "war baby". For many years this Company has been one of the largest manufacturers of flexible shaft machines for industry Constantly improving the design of our machines, we have brought the shafting to a high state of development. Recognizing our wide experience in this field, other manufacturers of mechanical products constantly consult us. As a result, we have assisted in designing this form of power transmission and remote control in many applications outside the machine tool field, especially today in mechanical weapons of war.

If you have a problem in remote control or power transmission, get in touch with us.

WALKER-TURNER COMPANY, INC.
4624 Berckman Street Plainfield, N. J.

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FLEXIBLE SHAFTING

FOR REMOTE CONTROL AND POWER TRANSMISSION

FUEL Economy AND FURNACE Efficiency

A battery of Fisher Electric Tilting Nose Pour Furnaces in a modern foundry in California. As a wartime emergency measure these furnaces were designed to be fired with either gas or oil with quick change-over. Capacities shown are 1200 pounds of brass, or 400 pounds of aluminum.

Correct furnace atmosphere is all important for best melting conditions with fuel economy at its highest and melting speed at its best for all purpose economy. Wartime light metal melting experience has established that the best conditions for pot life and efficiency of heating are reached when a "neutral" furnace atmosphere can be maintained with maximum CO_2 and only a trace of CO and free oxygen present. A prime requisite in obtaining this ideal condition is the use of multiple burners with a proportional mixer or equal for maintaining the proper gas and air mixture, and an air-oil ratio controlling device if oil is used.

These and other principles, although not commonly taken into full consideration, are a basic part of the design of Fisher Furnaces and are features which will be sought, after the day returns when low operating costs will be of first importance again. Fisher's Non-Ferrous Metal Melting experience also offers you (1) the benefit of many years of experience in foundry equipment coordination and (2) a wide selection of melting furnaces including electric and hydraulic tilting, hand tilting and stationary types incorporating the latest mechanical features, with a capacity for every purpose.
Present your Non-Ferrous Melting and Layout problems to Fisher. Write for complete information.

5525 North Wolcott Avenue, Chicago 40, Ill.

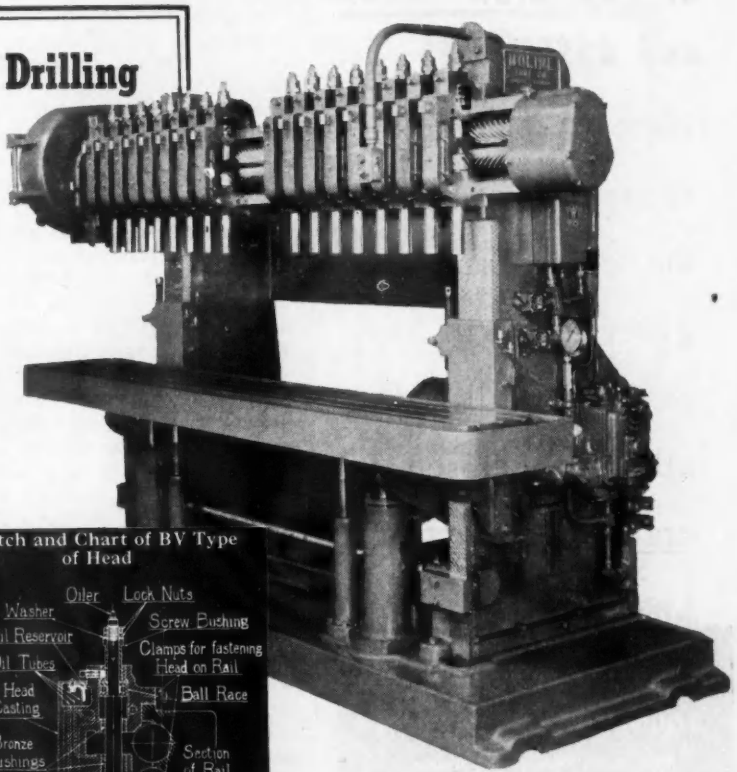
Fisher FURNACE COMPANY

Engineers and Manufacturers

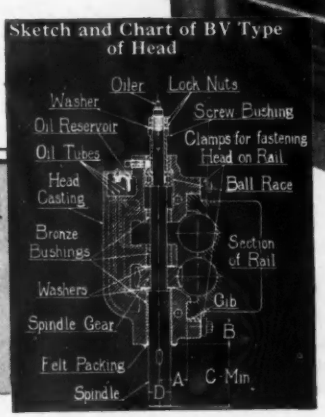
For Straight-line Production Drilling

of medium heavy castings, pipes, channels, angles or plates.

MOLINE HD 13 Drillers are unsurpassed for long-run production work, but can be changed over quickly and easily for new jobs—by simply respacing, removing or adding spindle heads on the rail, by selecting drive gears for correct rate of spindle rotation, and by adjustment of the electric push button controlled automatic feed cycle. The feed of the T-slotted table is actuated hydraulically and is equalized from end to end of the table by rack and pinion mechanism. The table is T-slotted for fixture mounting and positive stops can be provided for drilling or spot-facing to exact depths as well as jump feed feature for drilling tubular shapes.



Sketch and Chart of BV Type of Head



MOLINE HD 13 Drillers *are built in 6, 8 and 10 foot lengths, have a capacity of sixteen ¾" or thirty-two ⅜" drills in mild steel and can be furnished with "BV" type drill heads for drills from ⅜" to 2½" diameter.*

MOLINE TOOL CO. "HOLE HOG" MOLINE, ILLINOIS

DESIGNERS and BUILDERS of SPECIAL PRODUCTION MACHINERY *Since 1901.* "HOLE HOG" Drilling' Boring, Honing, and Tapping Machines.

Memo
for Post-War Production

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FOR FABRICATION OF PRECISION PARTS and ASSEMBLIES

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ADEC
AIRCRAFT & DIESEL EQUIPMENT CORPORATION
4401 North Ravenswood Avenue,
Chicago 40, Illinois
"Your Partners in Production"

Propeller Blades Precision Blades

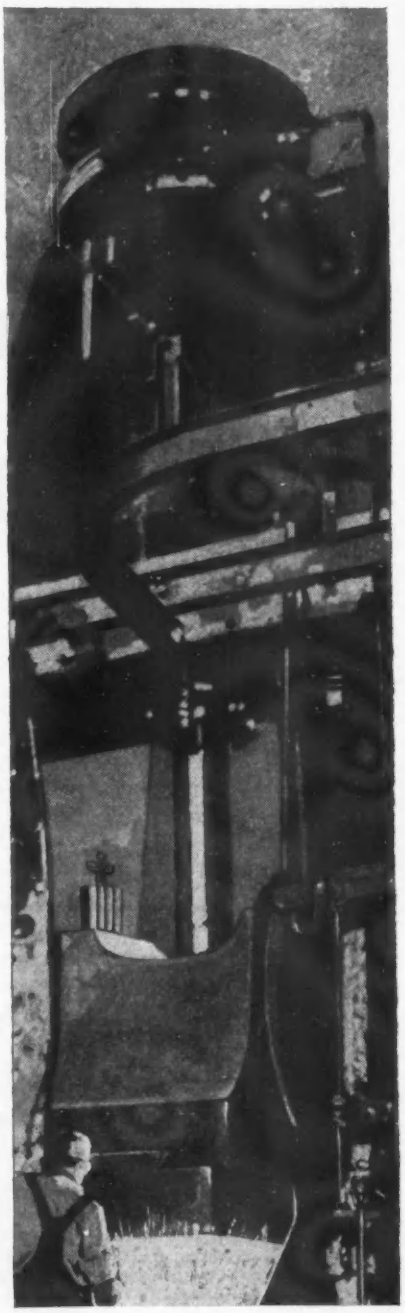
(*Continued from page* 24)

from 0.60 to 1 1/16 in. as required for the hub end. With .130 in. thickness at the tip end, over 30 pounds of metal must be machined off the airfoil zone to reduce the thickness of the tip end from .130 in. to .056 in. as specified.

The automatic rolling mill is designed so that it will repeat any number of passes with precision registration at a predetermined reduction with the proper metal distribution at each station (see Fig. 4). To form the bridge wall, the longitudinal die is used to force the metal into the deep groove of the roller. Testing of a two-roller system with a roller replacing the longitudinal die disclosed that depth control of the metal in the groove was practically impossible. It was found that the roller and longitudinal die combination will produce any blade shape possible with the two-roller setup and in addition excels in all forms of precision cavity rolling.

Skelps for hollow steel propeller blades of various sizes and construction can be rolled on this automatic mill. Fig. 5 shows a roller and die setup for automatic rolling a bridge wall structure from a tubular billet. Solid and tubular aluminum alloy blades also have been rolled at mass production speed on the mill shown in Fig. 1, which automatically rolls the pitch into the finished blade. Precision rolling also eliminates the common practice of machining the airfoil zone to secure gage thickness. The design of a tubular aluminum alloy blade and the operations when rolled with the automatic mill are illustrated in Figs. 6 and 7. The die setup for rolling the pitch in an aluminum alloy or steel blade is shown in Fig. 8.

Automatic rolling of propeller blades has demonstrated a number of advantages in finished metal distribution. It is understood that its development is being investigated in other countries, Early in 1939 the Russian government sent a delegation of expert propeller engineers to observe automatic rolling in action on the aluminum alloy blade shown in Fig. 8. Soviet officials submitted a contract to a leading manufacturer in this country for a large-sized automatic rolling mill, dies and billet fabricating equipment, and required that shop drawings be delivered with the signed contract. This stipulation for drawings scrapped the contract. At that time the Soviet engineers decided that automatic rolling was the solution to the mass production of propeller blades and ordered a rolling mill and equipment for fabricating 144 in. blades suitable for 4000 hp. engines. Unless we organize to employ applied science we will be the victims of those who do. In this struggle for industrial supremacy we either succeed or fail in the application of physical laws.



The forging of metal parts is and always has been the basic process in mechanical progress, whether in peace or in war.

Utmost strength and toughness with minimum weight is attained only in drop forging—more properly termed "impact die-forging." For it is the impact of the blow of the upper die on the hot metal resting in the lower die that gives to that metal the improved physical properties that fit it to withstand "unpredictable" loads and stresses.

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Begin with the finest cutting Fluids...

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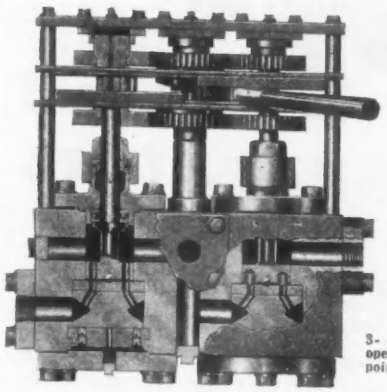

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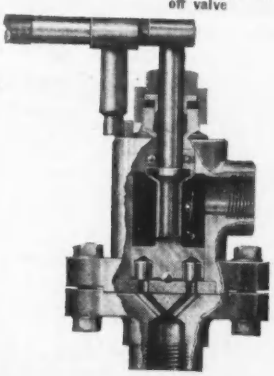
Operate— Quickly Easily Smoothly

3- and 4-way straight operating or neutral point operating valve

2-way angle and straight through shut-off valve



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Spiral Bevel — Straight Bevel — Spur — Herringbone — Helical — Worm — Hypoid and Complete Differentials

TODAY Fairfield's facilities for gear making are functioning at full capacity for the manufacturers of implements of war. As gears pour out in an endless stream for urgent war production, they are checked with customary Fairfield thoroughness for accuracy and conformity to specifications. Here are gears that will stand the test of gruelling use in war.

TOMORROW, there will be Fairfield gears produced in equal volume and quality to turn the humming wheels of post-war manufacture, construction and transportation. Study *today* your needs of *tomorrow* in terms of Fairfield gears.

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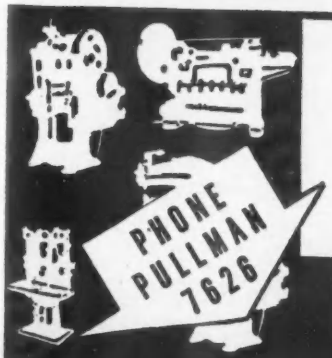
FAIRFIELD For FINE GEARS



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General "Stonewall" Jackson's axiom of war is also a principle of mass production.

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Take the easy way "conversion day". Call U. S. Automatic first.

U•S•AUTOMATIC
CORPORATION
Screw Machine Products
AMHERST • OHIO

Aircraft Has Become Principal Product of Automotive Industry

(*Continued from page 46*)

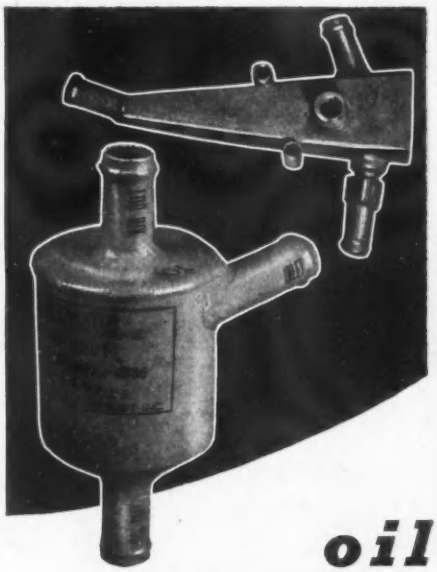
weight basis the West Coast plants turned out 274,078,000 pounds, 41 per cent of the national weight total and a gain of 67 per cent over 1942 airframe weight output of 164,189,000 pounds.

Ford Motor Co., one of the largest automotive builders of aircraft engines, has delivered more than 20,000 Pratt & Whitney 18-cyl., 2,000-hp. Double Wasp engines to the Army Air Forces. The first of these engines was produced by Ford in August, 1941, and volume output got under way a few months later. Among the manufacturing innovations introduced by Ford in making this engine were centrifugal casting of cylinder barrels, conveyorized sub-assembly, painting and inspection; decentralization of small parts manufacture to spread it among the Ford village industries in southeastern Michigan and designing of multi-purpose machine tools. The Ford-built Double Wasp engines are installed in the P-47, B-26, C-46 and the Vega PV-1 naval patrol plane.

The Dodge-Chicago plant of Chrysler Corp., one of the last aircraft engine plants to be built, is now in partial production, according to President K. T. Keller, and has shipped its first production engines to the AAF for the B-29. The plant includes 19 buildings and the No. 4 building contains 80 acres under one roof, making it comparable in floor area to Willow Run. The crankcase requires 247 manufacturing operations on 160 machines. Chrysler also has developed new methods for casting cylinder heads. The engine being built is the Wright 18-cyl. 2,200-hp. type.

Studebaker Corp. has passed the 100,000 mark in the production of military trucks, according to H. S. Vance, board chairman. Most of these were of the 2½-ton 6x6 type and the majority were shipped to Soviet Russia under lend-lease.

Munitions production in December maintained approximately the November rate, standing at 662 on the WPB production index, more than 6½ times the pre-Pearl Harbor rate (November, 1941, equals 100). The December rate is close to the average monthly rate scheduled for 1944, according to Donald M. Nelson, WPB chairman. Aircraft was up 5 per cent on a weight basis over November but ammunition output in December dropped 7 per cent, guns and fire control equipment were down 2 per cent and combat and motor vehicles decreased 1 per cent. Heavy truck production lagged in December, being only 3 per cent ahead of November. Self-propelled gun mounts fell off slightly in conformance with schedules. Artillery ammunition rose 10 per cent over November and is destined to continue upwards in 1944.



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the manufacture of various types of oil separators for use in the de-icing equipment of airplanes has long been an important activity at Mercury . . . complete tooling and experienced craftsmen give considerable advantage in quality, price and meeting schedules.

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MERCURY know-how, developed over 23 years devoted exclusively to aircraft fabrication, makes this company a dependable source of supply of aircraft parts and accessories, assuring quality unswerving and deliveries on schedule.

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Indispensable In Aircraft Motors!

BECAUSE precision in machining is a prerequisite to perfect functioning, leading makers of aircraft engine parts have for years entrusted this delicate work to Govro-Nelson.

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MERZ CAN MAKE IT!

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The Alcan road to Tokyo and the "Big Inch" pipeline required the development of more rugged and dependable power units. Clutch and power take-off improvements involved now are helping production equipment to do its sturdy share of the war job. Our engineers will be glad to give you the benefit of experience thus gained to help engineer better power transmission applications into your product, with latest model—

ROCKFORD *Industrial* CLUTCHES *and* POWER TAKE-OFFS

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Give capacities, dimensions and specifications. Show HOW exclusive features of ROCKFORD CLUTCHES and POWER TAKE-OFFS are utilized to give your products competitive advantages.

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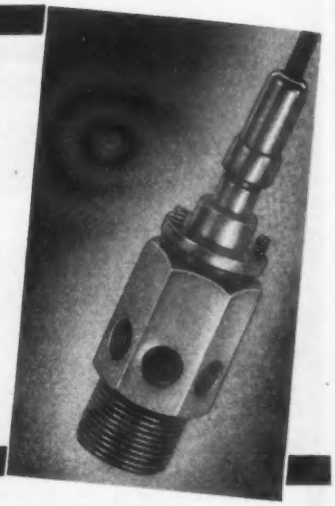
NEW IMPROVED PICK-UP no. 3000B

High Sensitivity—Constant Polarity—Operates at High Temperatures

The new improved Electro Pick-Up No. 3000B has a bayonet type socket which provides quick, reliable contact between connection cable and pick-up ★ Adaptor adjustments much simpler because of the use of 2 new set screws replacing the older type hexagonal nut. This new construction permits easy installation and removal from the engine with an ordinary socket wrench.

The pick-up coil has special impregnation that withstands continuous operating temperatures of 350° ★ Engineered to provide quick replacement of diaphragm or coil for extra economical operation and long life ★ When used with Electro Integrator, will provide indication of pressure variations in reciprocating engines, pumps, etc. Write for further information.



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GRAND Speed CLAMPS

The Most Complete and Up-to-the-Minute Line of Modern Time-Saving Clamps

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Ground Clamp

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Screws, Swivels and Handles
COPPER PLATED
against Welding Spatter

QUIKCET for fast (4-second) Clamping—Instant ratchet set and release, fulcrum screw tightening, 1-hand operation and a non-creeping grip even on irregular surfaces. Setting the pace in war production.

DUAL GRIP — Double action malleable clamps. Side tightening for close working conditions. No twisting or creeping.

WELDERS' GROUND CLAMP. Completely copper plated, with connection for ground wire.

ALLOY-STEEL Medium and heavy service "C" Clamps of even greater than forged clamp capacity. Also a complete line of Malleable "C" Clamps.

HEAVY DUTY SPEED CLAMPS. 2-handed, lever locking and instant release. Also Giant 10½" opening size.

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Quick Lockcet

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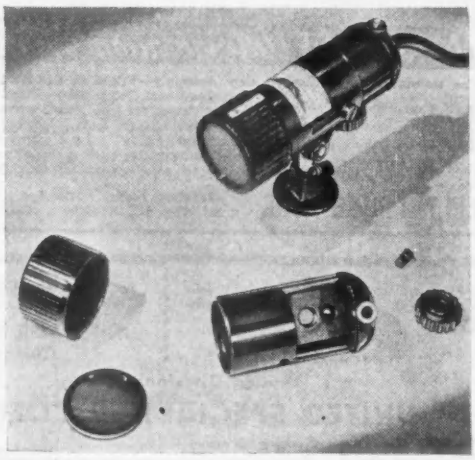
METAL PARTS WASHERS AND DEGREASERS FOR DEFENSE PRODUCTION *Speed*



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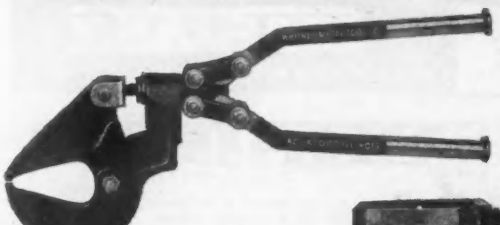
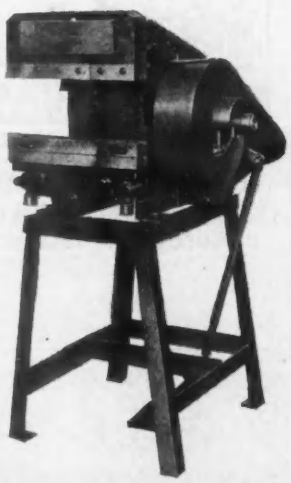
30 YEARS EXPERIENCE





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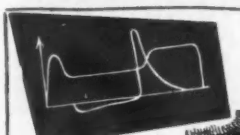

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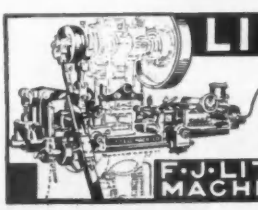

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FOR FASTER SPEEDS

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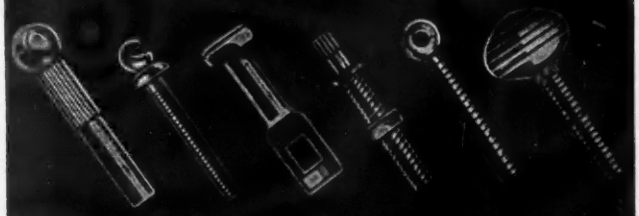

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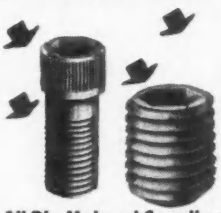

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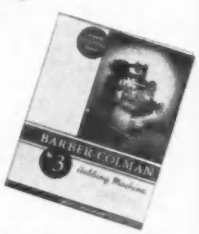

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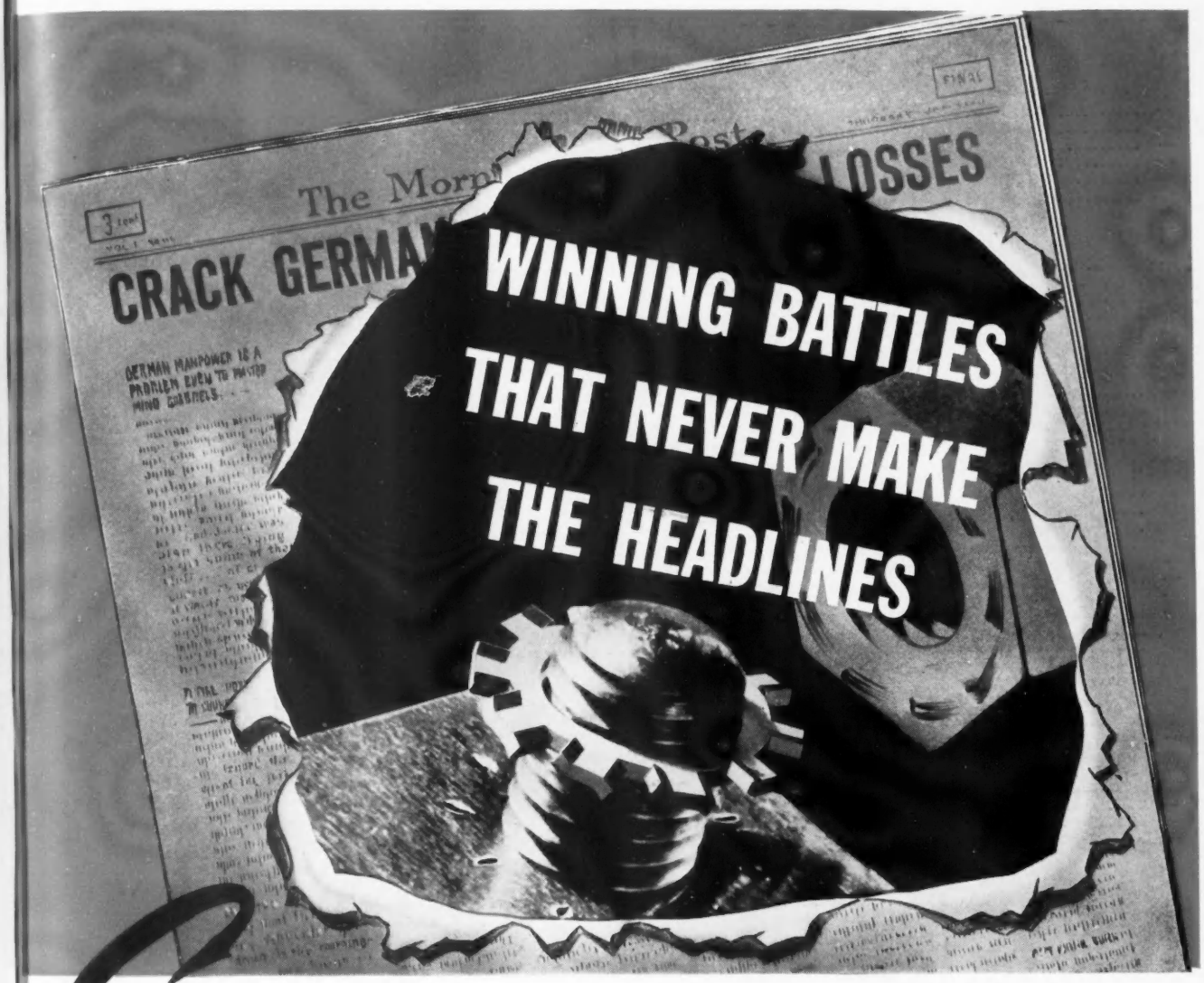

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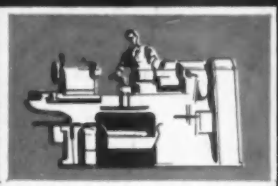

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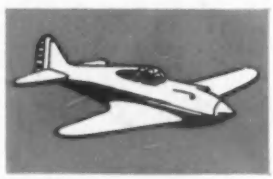

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